CHAPTER 4

Recent LAC Experiences: The Role of Knowledge and Institutions

This chapter focuses on country experiences, most of them dealing with specific sectors. The role of nontraditional endowments, such as geography, knowledge, institutions, ICT, and foreign direct investment (FDI), seems to be key for the performance of emerging economic activities in LAC. This is true for a variety of production processes, ranging from fruits in Chile to computer electronics in Costa Rica and Mexico, and tourism in the Caribbean. Moreover, it is also clear that trade liberalization and regional integration also helped diversify the structure of exports in most countries. NAFTA was particularly important for Mexico, while Mercosur was important for Argentina.

The EPZs in Central America and the Caribbean have helped these countries take advantage of their close proximity to the United States. It seems that such arrangements can provide an institutional safe haven in terms of relatively stable regulations for FDI, although corporate tax incentives need to be reviewed in the near future. In both Costa Rica and Mexico, however, human capital and FDI have jointly stimulated the emergence of knowledge-intensive manufacturing activities. Hence the role of knowledge and human capital cannot be overestimated in the promotion of dynamic FDI. The experience of Costa Rica’s CINDE also shows that proactive FDI promotion policies undertaken jointly between the private and public sectors can yield handsome rewards for development.

In the future, ICT development might enhance the performance of industries ranging from the maquila sector in Mexico and Central America to the tourism business in the Caribbean.

In addition, support from the public sector for research and development was a key ingredient in Chile’s agricultural success story, and in the recent commercial success of Brazil’s EMBRAER. The case of agriculture in Chile also indicates that macroeconomic management was a key ingredient for the success of the sector after the mid-1980s.

The case studies that follow provide specific examples of how policies can affect economic structure with desirable consequences. In the end, the path from the use of natural resources to the knowledge economy is aided by intelligent policies, combined with the types of new endowments discussed in the recent scientific literature (see Chapter 2). The dynamic potential of combining national strengths, such as geography, abundant natural resources, natural beauty, and even cultural heritage, with other modern factors of production such as sound institutions, ICT, and knowledge is a good recipe for growth and development.

There is thus a clear similarity between the recent LAC experiences discussed in this chapter and the historical experience of the industrialized countries reviewed in Chapter 3: in both instances the emergence of new industries depended on how countries played to their strengths, ranging from abundant natural resources to geographic factors, by progressively applying new technologies and knowledge to their production processes, while strengthening ties with the global economy.
Chile’s Agricultural Performance: The Case of Fresh Fruits Exports

Economic reforms in Latin America have been followed by concerns regarding the impact of trade reforms on the performance of the agricultural sector. These doubts encompass several issues, ranging from the dynamism of the sector to its effects on poverty (see Foster and Valdés 2001).

In this section, we focus mainly on the case of Chile, but we begin by analyzing the productive performance of the agricultural sector in LAC countries before and after the reforms. We investigate whether economic reforms brought improvements in the productivity and export performance of agriculture. But even after the reforms, Chilean agricultural performance was still outstanding compared to the rest of the region. We find that part of the explanation is the long history of applying knowledge to the development of new exportable agricultural products.

Economic Reforms and the Performance of the Agricultural Sector in LAC

Table 4.1 presents some basic information for several LAC countries.1 It indicates the year in which economic reforms were adopted in the different countries, according to the independent analysis of Sachs and Warner (1995a). The table also summarizes the behavior (average annual growth rates) of agricultural labor productivity and exports per worker, before and after the reforms.

A quick glance at Table 4.1 reveals that Chile was the top agricultural performer during 1980–99. Furthermore, in the vast majority of cases, the performances of productivity and exports per worker were better in the period after the reforms. Nevertheless, for individual countries, the difference in performances is statistically significant only for a handful of cases, probably due to the limited number of observations in the different periods. Table 4.1 suggests that with respect to efficiency, the reforms tended to benefit agriculture. More detailed empirical analyses of the impact of the economic reforms on the performance of the agriculture sector is presented in Lederman and Soares (2001). In general, the evidence indicates that reforms tended to have an immediate effect of reducing the productivity growth in agriculture relative to Chile, and this reduction was recovered after approximately three-and-a-half years. This result is illustrated in Figure 4.1. On average, at the time of the implementation of reforms, LAC countries were underperforming relative to Chile by about 3 percent. After the initial decline, the gap between LAC agricultural productivity and Chile became less severe with time. Also, on average, reforms tended to have an immediate positive impact on the growth of exports, and this impact tended to be progressively intensified over time.

Econometric Results

The country-by-country analysis discussed in Lederman and Soares (2001) shows that the general pattern observed in the

<table>
<thead>
<tr>
<th>TABLE 4.1</th>
<th>Date of Economic Reform, Growth of Labor Productivity and Exports per Worker in Agriculture, Selected Latin American Countries, 1980–99</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNTRY</td>
<td>YEAR OF REFORM</td>
</tr>
<tr>
<td>Argentina</td>
<td>1991</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1985</td>
</tr>
<tr>
<td>Brazil</td>
<td>1991</td>
</tr>
<tr>
<td>Chile</td>
<td>1976</td>
</tr>
<tr>
<td>Colombia</td>
<td>1986</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1991</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1989</td>
</tr>
<tr>
<td>El Salvador</td>
<td>1988</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1991</td>
</tr>
<tr>
<td>Honduras</td>
<td>1986</td>
</tr>
<tr>
<td>Mexico</td>
<td>1990</td>
</tr>
<tr>
<td>Peru</td>
<td>1990</td>
</tr>
<tr>
<td>Uruguay</td>
<td>1990</td>
</tr>
</tbody>
</table>

Note: Variables are growth rates (difference in natural logarithms) of value added in agriculture, forest, and fishing per worker (labor force); and total exports (FOB) of agricultural products per worker (labor force); both in 1990 U.S. dollars.

aggregate for productivity could also be seen in each individual country. Overall, the results suggest that, with respect to efficiency, the reforms tended to bring long-term benefits to the agricultural sector. In this respect, concerns about the impacts of economic liberalization on the performance of agriculture seem to be misplaced. Yet Chile still outperformed the other LAC economies due to its long history of reforms, its adequate macroeconomic management, and its historical investments in knowledge and innovation in agriculture. In the following paragraphs we look more closely at the Chilean experience, with a special focus on the role of macroeconomic management and knowledge creation.

Reforms and Changes in Incentives in Chilean Agriculture

The trade reforms most immediately affected the incentives facing producers through changes in the prices of tradable goods. This yielded incentives to move resources from import-competing goods toward the export-oriented and nontraded sectors. A central goal of reform in general, and especially with respect to agriculture, was to reduce the explicit and implicit anti-export bias that existed previously. Imported input prices also fell as tariffs decreased with liberalization, which was a significant element in determining the effects of reform for some countries.

In addition to the changes in direct price incentives brought about by freer trade, there were other price effects induced by deregulation and privatization and other aspects of the reform process. Perhaps more important for the farm sector were the indirect effects of exchange rates and interest rates, two key prices to which the sector is particularly sensitive. By now it is well recognized that the exchange rate is the most important "price" affecting the agricultural economy (Valdés 1986). We now examine the effects of reform on sector prices.

Net Rates of Protection

To examine the long-term trends in the evolution of incentives in the farm sector, the most general measure is the value added of agricultural activities relative to nonagricultural activities. Most trade and price policies are restricted to tradable goods in the case of agriculture, and most agricultural goods in LAC countries are tradables. Box 4.1 reviews the algebra of a relevant indicator of relative price incentives—the net rate of protection (NRP). The rest of this section reviews the evidence concerning NRPs for various agricultural commodities in Chile.

As the NRPs in Table 4.2 show, prior to 1974 Chile favored export-oriented crops (apples and grapes) and most import-competing commodities (beef, maize, milk, sugar beets, and wheat). Immediately following 1974, the NRPs for exportables fell to very low rates, and since the initiation of the second phase of reforms in the early 1980s, NRPs have effectively been zero. For import-competing crops the story is notably different. The NRPs for milk and wheat were relatively high in the decade of the 1960s. Measured NRPs during the early 1970s are not very meaningful, given the regime of price controls, hyperinflation, shortages, and rampant black markets. NRPs were relatively high during 1984–89 due to the government’s response to the strain on the traditional farmer sector arising from low international prices and a strong appreciation of the currency between 1979 and 1982. Chile instituted price bands for wheat, sugar, and oilseed, and minimum import prices for milk during that time. Although there was a currency depreciation in the late 1980s, protections remained. During the 1990s, the currency again appreciated, and the already instituted price bands cushioned traditional producers.

Table 4.2 shows the decomposition of real domestic prices for selected Chilean agricultural products for the period from 1960 to 1993 or 1995. For example, during 1975–83 the average 0.18 percent decrease in the real price of milk is the result of a 2.39 percent decrease in the real border price, a 46.47 percent increase in the real exchange rate, and a 44.26 percent decrease in price supports. As the
The algebraic expression that captures the returns to primary factors may be written as the value added of agriculture relative to an average value added in nonagriculture (tradables and home goods):

\[
\frac{VA_a}{VA_{NA}} = \frac{VA_a}{\alpha VA_a + (1-\alpha)VA_n}
\]

Although this has been used occasionally for the case of specific commodities (for example, Hurtado, Valdés, and Muchnik 1990), more commonly relative prices substitute for value added measures:

\[
\frac{P_a}{P_{NA}} = \frac{P_a}{\alpha P_a + (1-\alpha)P_n} = \frac{P_a}{\alpha P_a + (1-\alpha)}
\]

The effects of trade and price policies are captured by the effective and net rates of protection (ERP and NRP), which compare prevailing domestic price ratios with those that would exist with free trade. The ERP is the most relevant to capture the impact on incentives; the NRP is better suited to measure the effects on prices paid by consumers. It should be noted that most studies on agricultural protection measure ERP and NRP by direct comparisons between border and domestic prices, adjusted for internal transport costs, quality difference, and other factors, because traditionally, especially in agriculture, there were several forms of intervention (nontariff barriers) and not simply tariffs. With a simple tariff (export taxes) as the only instrument restricting importables (exportables), these measures should reflect the explicit tax charged.

What these measures do not capture is the effect of what is called indirect protection (Krueger, Schiff, and Valdés 1988), which includes possible misalignment of the exchange rate and the effects of industrial protection on domestic relative prices. The net and effective rates of protection (positive or negative) can be adjusted accordingly. The total adjusted NRP (incorporating direct and indirect interventions) may be expressed for a specific agricultural good \( i \):

\[
NRP_T = \frac{P_i}{P_{NA}} - 1
\]

where the \( P_i^* \) is the counterfactual border price adjusted for exchange rate misalignments, and \( P_{NA}^* \) is the counterfactual price of nonagricultural goods adjusted for both industrial protection and exchange rate misalignment.

**Research and Development in Chilean Agriculture**

While many reformers have tended to retreat from development-oriented institutions concerned with the farm sector, it has been broadly accepted that the unsuccessful delivery of supportive services of such institutions can impede the achievement of reforms. The ability of R&D services to contribute to productivity growth, especially in the case of poor farmers, can ameliorate the negative and enhance the positive effects of trade liberalization (Tabor 1995). This in turn can make the implementation of agricultural reforms more palatable. In addition, strengthening the growth of the agricultural sector through technical change and productivity growth can improve overall employment, income growth, and food price levels, thus easing the costs of adjustment more generally. In particular, strengthening export agriculture can directly earn for-
eign exchange and indirectly finance imports. Yet, to some extent, the private sector usually replaces public support by opening new avenues for the agricultural sector to achieve technological and managerial advances (Umali 1991). In terms of who its “clients” are, however, private support is more likely to be oriented toward larger, commercial farmers than the public sector, especially toward those in growth sectors, which are often the export sectors in the case of LAC.

In the case of Chile, the role of R&D in agricultural performance is most clearly observed in the fruit sector. This experience is narrated in Box 4.2. The rest of this section reviews the role of R&D policies more generally.

Prior to 1973, agricultural research in Chile was concentrated in the Agriculture Ministry’s parastatal Instituto Nacional de Investigación Agraria (INIA). The agency was responsible for all scientific specialties, crops, and regions. In terms of both funding and personnel, other institutions,

### TABLE 4.2

#### Decomposition of Producer Price Changes in Chilean Agriculture

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>PERIOD</th>
<th>REAL DOMESTIC PRICES (%)</th>
<th>REAL BORDER PRICES (%)</th>
<th>REAL EXCHANGE RATE (%)</th>
<th>(1 PLUS THE) TARIFF RATE (%)</th>
<th>OTHERS (%)</th>
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</thead>
<tbody>
<tr>
<td>Exportables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples, red</td>
<td>1960–70</td>
<td>153.77</td>
<td>41.02</td>
<td>30.94</td>
<td>17.14</td>
<td>44.67</td>
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<tr>
<td></td>
<td>1971–74</td>
<td>-2.4</td>
<td>-21.22</td>
<td>44.77</td>
<td>-10.38</td>
<td>-15.58</td>
</tr>
<tr>
<td></td>
<td>1975–83</td>
<td>6.4</td>
<td>-8.4</td>
<td>46.47</td>
<td>-6.77</td>
<td>-24.9</td>
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<tr>
<td></td>
<td>1984–89</td>
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<td>36.11</td>
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<tr>
<td></td>
<td>1990–93</td>
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<tr>
<td></td>
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<td>54.35</td>
<td>4.37</td>
<td>44.77</td>
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</tr>
<tr>
<td></td>
<td>1975–83</td>
<td>41.51</td>
<td>20.91</td>
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<tr>
<td></td>
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<td>21.37</td>
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<td>17.67</td>
</tr>
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<td>Importables</td>
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<td></td>
</tr>
<tr>
<td>Beef</td>
<td>1960–70</td>
<td>41.2</td>
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<td>0.69</td>
</tr>
<tr>
<td></td>
<td>1971–74</td>
<td>87.27</td>
<td>42.14</td>
<td>44.77</td>
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<td>-76.06</td>
<td>46.47</td>
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<td>-22.12</td>
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<tr>
<td></td>
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<td>136.69</td>
<td>64.93</td>
<td>33.67</td>
<td>13.98</td>
<td>24.12</td>
</tr>
<tr>
<td></td>
<td>1990–95</td>
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<td>16.88</td>
<td>-26.84</td>
<td>-3.54</td>
<td>-16.54</td>
</tr>
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<td>Maize</td>
<td>1960–70</td>
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<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>1971–74</td>
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<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>1975–83</td>
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<td>n.a.</td>
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<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>1984–89</td>
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<td>-45.12</td>
<td>25.27</td>
<td>-7.84</td>
<td>23.46</td>
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<td>-23.84</td>
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<tr>
<td>Milk</td>
<td>1960–70</td>
<td>3.29</td>
<td>-5.37</td>
<td>30.94</td>
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<td>-22.28</td>
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<tr>
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<td>1971–74</td>
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<td>14.27</td>
<td>44.77</td>
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<td>18.4</td>
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<tr>
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<td>-2.39</td>
<td>46.47</td>
<td>0</td>
<td>-44.26</td>
</tr>
<tr>
<td></td>
<td>1984–89</td>
<td>-6.25</td>
<td>9.46</td>
<td>33.67</td>
<td>13.98</td>
<td>-63.53</td>
</tr>
<tr>
<td>Sugarbeets</td>
<td>1960–70</td>
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<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>1971–74</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
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<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>1975–83</td>
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<td>n.a.</td>
<td>n.a.</td>
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</tr>
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<td></td>
<td>1984–89</td>
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<td></td>
<td>1971–74</td>
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<td></td>
<td>1984–89</td>
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<td>-12.84</td>
<td>-26.84</td>
<td>7.84</td>
<td>4.04</td>
</tr>
</tbody>
</table>

n.a. Not applicable.

including universities, contributed a small proportion to the overall system of agricultural research. Private sector efforts were relatively slight; research investments in 1973 represented only 2 percent of the annual budget of INIA (Venezian and Muchnik 1994). With the introduction of reforms, while direct public funds remained at a level of less than a half percent of agricultural GDP, the development of other funding sources led to at least a doubling of

BOX 4.2
R&D Policies and the Emergence of the Fruit Sector in Chilean Agriculture

The most dramatic story occurs in the fruit sector where exports grew at a rate of 20 percent annually in the first 20 years since the reforms of 1974. Areas planted to commercial orchards almost tripled and fruit production quadrupled. Jarvis (1992) attributes this success to the speed with which Chileans were able to transfer, adapt, and extend fruit technologies initially developed for California and other fruit-growing regions to Chile. He argues that private initiative in these areas was driven by changes in price relationships and industry structure that increased returns to private R&D. The Corporación de Fomento (CORFO) played an important role in the early 1960s in surveying existing fruit orchards, analysis of potential demand in foreign markets, elaboration of production goals, introduction and screening of new varieties, establishment of nurseries to propagate disease-free plants, construction of cold-storage facilities at strategic locations to promote postharvest care, phytosanitary inspection of exported fruit, establishment of favorable credit lines and working capital, and “drawback” payments for fruit exports. In 1965 a 10-year program of cooperation between the University of California and the University of Chile was established to permit technical cooperation and improve graduate training. This helped the University of Chile develop a first-rate faculty in fruit-related sciences and to begin modern fruit research. Spillover effects strengthened government agencies and other universities. As one crude measure, Jarvis documents that the number of theses on fruit issues submitted for the Agricultural Engineering degree increased by 2.5 percent and as a share from 13 to 31 percent from 1976–80 to 1986–1990. In 1964 Chile established the National Institute of Agricultural Research (INIA), which paid relatively high salaries and attracted skilled researchers. The agency initiated a fruit research program from the start. By these means, Chile developed the scientific personnel and knowledge to achieve technological transfer, identified and began to plant new varieties suitable for foreign markets, improved orchard and postharvest management, upgraded fruit research and teaching, and developed the infrastructure necessary to export fruit to foreign markets. Jarvis notes that the bulk of these developments were carried out by the public sector. Exports rose slowly across this period and several export companies emerged that gained experience with foreign markets. Chilean firms achieved the volume needed to charter special fruit cargo ships. Fruit handling, better cold-storage management, and reduced transit times allowed improvements in fruit quality at destination.

Significant barriers remained. Uncertainties surrounding land reform and macropolicy of the late 1960s and early 1970s deterred private investment. Import quotas and high tariffs, slow and inefficient transport and port handling, and bureaucratic red tape slowed progress. With the policy reforms of the early 1970s, quota restrictions on imported inputs were reduced, and in 1976 import tariffs were cut to a uniform 10 percent from the previously high average level of 96 percent. Export procedures were streamlined and labor unions were proscribed. Strong world prices for fruit and a competitive peso raised returns to capital in the range of 25 to 50 percent.

Chile improved technology at all levels of the production chain—domestic transport, port operation, international shipping, banking, and telecommunications—and in all aspects of fruit production, packing, and cold storage. Jarvis examines in detail particular gains in planted varieties, management, and transport, and the private channels of technology dissemination. The number of fruit entrepreneurs increased four-fold. Jarvis further concludes that there were strong spillovers to other sectors that saw the possibilities of exporting. Most of the innovation was carried out by the private sector, although Jarvis wonders about the need for public provision as fruit markets have become tighter.
total support for agricultural research—from 0.4 percent of sector GDP to 0.9 percent between 1973 and 1992.

In the spirit of the economic reforms after 1975, several institutions were created to promote private sector participation and competition in research and development. The operation of these institutions required the use of either collaborative funding or research (or both) originating in the private sector. Moreover, the support of these institutions was for the most part open to rivalry across regions and between researchers in any economic sector. Except for the Ministry of Agriculture’s research fund (Fondo de Investigación Agrícola, FIA), research directed toward the farm sector had to compete for resources available to all types of investigations.

A national fund for science and technology (Fondo Nacional de Desarrollo Tecnológico y Productivo, FONDECYT) was established in 1982, and the national development corporation created a research fund (FONTEC) in 1984. More important for university-based research, a 1989 law introduced tax incentives for research donations to institutions of higher education, and 1992 saw the implementation of the development fund Fondo de Fomento al Desarrollo Científico y Tecnológico (FONDEF), in support of R&D, which was underwritten with an Inter-American Development Bank loan. By 1990 private expenditure on agricultural research had increased 19 times its 1973 level, and represented approximately 13 percent of total spending on research in the sector. Within a few years following the introduction of FONDEF, private spending nearly doubled to about 20 percent of total farm sector research expenditures. The greater diversification of institutions and sources of financial support for farm sector R&D was accompanied by a shift in the nature of funding for the largest research institution, INIA. Prior to the reforms, INIA relied on taxpayer monies for 90 percent of its budget, the remainder coming from sales of services and seeds and other farm products. Following 1975, government policy pushed INIA toward self-financing. By 1985 the institution was earning 40 percent of its income from sales and another 20 percent from grants, loans, and other nongovernment sources.

The increased availability, diversification, and private direction of funding sources was associated with a greater weight given to research on exportable crops and the investigation of postproduction technologies, product characteristics and quality, and other topics important to commercial agriculture. While the previous emphasis on traditional crops by INIA was continued by that institution, the private sector and universities adapted quickly to the new incentives generated by reforms. Magnifying the effect of domestic research activities related to commercial agriculture generally, and to export agriculture especially, was the easy availability of proven crops and technologies from abroad, most notably from California. For-profit research activities proliferated, especially where the returns to the identification and adaptation of new varieties and methods were more easily internalized.

The human capital and experience officially located in INIA, but put to use by private enterprises, were important elements in the initial identification and evaluation of varieties and technologies accessible from abroad. As R&D in the service of private interests gained in stature and funding, INIA expanded its area of responsibility and replaced in part previous government services that had been unable to survive in the political environment following the initiation of reforms. Moreover, the political adherence to market-based solutions, and the obvious successes of commercial farmers, exporters, and processors, called into question public support for activities that otherwise might be sustained by private interests. As a result, INIA’s role evolved toward a focus on smaller-scale agriculture. Nevertheless, one consequential benefit to all agricultural interests that followed the institution’s adoption of a development role was the enhanced coordination of research with the demands of farmers.

The Chilean experience related to the contributions of agricultural research and development reinforces the importance, within the context of overall reform, of deregulation and privatization in the provision of more-reliable and lower-cost services. The climate that permitted these contributions, however, has also tended to de-emphasize longer-term research questions and the institutional infrastructure that supports scientific research, development, and training leading to benefits not easily internalized by private concerns. The net cost or benefit of such a shift in the balance of agricultural research and development policy away from long-term issues is not obvious. It is also worth noting that the successes of the Chilean system in responding to the incentives brought about by the reforms were made possible not merely by the similarity of Chile’s natural resources to those of regions in more economically advanced countries. Regardless of its deficiencies, the pre-reform agricultural research system had sustained a pool of
human capital that, however inefficiently employed, was available for use when the reforms shifted the emphasis onto private efforts. Box 4.3 discusses more general issues concerning the design of R&D incentive programs.

**Argentina’s and Uruguay’s Export Diversification after Liberalization**

**A Unilateral and Regional Liberalization in Argentina and Uruguay**

Argentina’s and Uruguay’s trade liberalization was accomplished by policies applied unilaterally and regionally, and within the multilateral negotiations under the auspices of the General Agreement on Tariff and Trade/World Trade Organization (GATT/WTO). The process of trade liberalization in Argentina started as a unilateral policy in 1988, with the so-called Canitrot Reform. At the beginning of 1991, trade liberalization was pushed even further; the average tariff fell to an unprecedented level of 12.2 percent in mid-1991. Overall, this unilateral liberalization reduced the average tariff in Argentina from 45 percent in 1987 to around 13 percent in 1994 (Berlinski 1998).

The process of trade liberalization in Uruguay also received a strong push in the early 1990s, but trade liberalization had been pursued without major interruptions since the end of the 1970s. The tariff reduction in Uruguay was accelerated after 1990. The average nominal protection declined from 30 percent in 1990 to 17 percent in 1993, and reached 13 percent in 1995.

From 1995 onward, trade policies in Argentina and Uruguay were set within Mercosur. This integration initiative was established among Argentina, Brazil, Paraguay, and Uruguay in 1991 with the signing of the Asunción Treaty. In its first article this treaty states that the aim of the agreement is to achieve “the free circulation of goods, services and productive factors among the member countries, through the elimination of the tariff and nontariff restrictions to the circulation of merchandises and of any other equivalent measure.” It also established a Common External Tariff (CET) and a common commercial policy toward the rest of the world. The full implementation of free trade within the region and the establishment of the CET were scheduled for 1995. These objectives were partially achieved with significant exemptions (for details, see Bouzas 1996; Terra 2000; and Sanguinetti, Pantano, and Posadas 2001a).

By 1996, the member countries were, on average, pretty close to the liberalization objectives. While the external tariff in Argentina and Brazil converged from above toward the CET, those of Paraguay and Uruguay approached the CET from below, thus reflecting the relatively lower level of protection that those countries had initially, compared to their big neighbors. Regarding the tariff levels observed for the exempted items, the small countries set very high tariffs for the excluded items. On the other hand, the big countries, in particular, Brazil, have high tariffs on the external excluded items (21.39 percent). This fact could potentially play an important role in encouraging exports from Argentina and Uruguay to the Brazilian market. This hypothesis is explored further below.

**Diversification Indicators**

In this section we investigate the precise nature of the changes outlined above. Particularly, we focus on the degree of export diversification. Following Sapir (1996) we construct the Gini coefficient and the Theil Coefficient to measure the extent of diversification of exports and imports in both countries. The Gini Coefficient ranges between 0 and 1. For example, a high Gini Coefficient is associated in the income distribution literature with high-income inequality. In our context, it will be an indicator of a highly concentrated trade structure. Different indicators weight differently changes in the distribution of export and import shares, so it is a good practice to check the robustness of results to different indicators. Table 4.3 presents the Gini and Theil Coefficients for Argentina and Uruguay.

Several observations can be made. First, the evolution of diversification does not depend on the indicator we use. Second, as one would have expected for a small country like Argentina, exports are more concentrated than imports throughout the period. Third, imports and exports show a consistent decline toward greater diversification. However, export concentration declined steadily and continuously while the import concentration indexes show a structural change around 1991 and 1992, when trade liberalization was implemented.

For Uruguay, exports are also more concentrated relative to imports, and both indicators decline in the period (greater diversification). Again, as in the case of Argentina, the concentration of imports declined sharply at the beginning of the 1990s, reflecting the deepening of trade liberalization policies taking place in those years. Indeed, this...
R&D has long been recognized as an important factor determining the pace of economic development. They reduce production costs of existing products and create new ones, thus contributing to sustained growth and enhancing economic welfare. Recent microevidence for Ireland also shows that, at the plant level, R&D-active firms are usually associated with plants with higher survival rates and higher job quality (Kearns and Ruane 2001). But there are externalities and public good features of investments in R&D that tend to make decentralized solutions—market outcomes—inefficient. These are related to the generation of knowledge that can be publicly used, and to externalities typical of human capital investments. For these reasons, governments usually use incentive devices to increase R&D investments and to try to attain a socially optimal allocation of funds for R&D.

The most common incentive takes the form of tax credits for investment in R&D. The rather scarce evidence suggests that these incentives increase investments in research, and that each additional dollar in tax credit for R&D stimulates roughly one additional dollar of R&D (Hall and Van Reenen 2000). The impact is relatively small, and does not seem to have a multiplier effect on private investment decisions. Considering that firms usually adapt their accounting practices to tax laws and incentives, this figure implies that each dollar given away through tax exemptions is probably associated with less than one additional dollar really spent on R&D. The natural question, therefore, is whether these resources would be better allocated if directly managed and invested by the government in specific R&D programs.

One alternative is a subsidy in the form of cost sharing of R&D investments between the private and public sectors. In this case, the public sector would add a defined amount for each dollar invested by private firms. In terms of instruments, and of the impacts on government accounts and R&D expenditures, a scheme like this would probably be equivalent to a tax credit system, since the tax incentive can be set at any percentage of the total R&D investment by private firms. Hence it is always possible to reproduce the fiscal and R&D impacts of a given cost-sharing system with some specific tax credit structure. But there are operational differences between these two systems. Table 4.4 summarizes some of the issues to be considered when discussing incentives for R&D.

The cost-sharing scheme allows the government to partially control the composition of investments in R&D, which in principle can be used to enhance welfare. It also assigns the monitoring of programs to special public institutions (such as development agencies), which are possibly more capable of checking the appropriate use of resources than a tax agency restricted to looking at the accounting statements, as in the tax credit system. But the cost-sharing mechanism also has its drawbacks. In principle, it is questionable whether the public sector has a better ability than the private sector to decide what are the investments with higher social return. The decision process inside the government is certainly affected by rent-seeking and political lobbying, thus increasing the uncertainty in relation to the optimality of the outcome. Also, although development agencies already exist in most countries, a system of public subsidies would possibly overload the existing institutions and increase operational costs. All these factors have to be weighed against the problems of the tax credit system. These include the fact that, in this case, the whole decision process remains delegated to the private sector. The effectiveness of tax credits is limited by the possibility of its use for tax-evasion purposes and the increased complexity of the resulting tax structure.

Therefore, the choice between the two systems, or the ideal design of any of them, is far from clear. Which of the factors mentioned above is the most important one probably depends on the specific productive and political structure of each country. In this sense, there seems to be space for experimentation, using pilot programs and the institutional structures already in place in the different countries. This would reveal the differential impacts of the alternative structures in different environments, giving a more solid guide for policy decisions. In any case, the issues mentioned here should be kept in mind, because they are factors that will determine the costs and benefits of R&D incentive programs, including their fiscal impact, the response of private R&D expenditures, the composition of R&D expenditures across sectors, the monitoring mechanisms, and the potential political and institutional constraints.
increase in the varieties of imports was great news for consumer welfare in both countries.

**Decomposition of Concentration by Sectors and Regions**

In this subsection we present a more detailed analysis of the driving forces behind the evolution of concentration of exports. The analysis first uses variants of the Theil Coefficient to determine the extent to which trade diversification in Argentina and Uruguay occurred either within product groups or between product groups. In turn, the analysis explores the impact of Mercosur on trade concentration in Argentina.

**Decomposition of Export Concentration by Sectors**

The Theil decomposition analysis allows us to check whether diversification occurred either within or between product aggregates. Figure 4.2 presents the results for Argentina. The main conclusion is that a large share of the diversification of exports of Argentina is accounted for by within-group diversification. Almost 80 percent of the decline in the Theil Coefficient is explained by within-group diversification, and this proportion remained stable during the entire period. On the import side (not shown), we observe an increase in the participation of between-group diversification since 1991 (around 40 percent), suggesting a significant effect of trade liberalization on the composition of imports at a very aggregate level of products.

Figure 4.3 shows the calculations for Uruguay. The results are similar to those obtained for Argentina in the sense that most of the diversification is explained by within-group diversification. The main difference is that we find a stable behavior of the participation of within-group (and between-group) diversification during the entire period for both exports and imports (not shown).

**Diversification Indicators by Region: Mercosur and the Rest of the World**

A final important aspect of the behavior of the diversification indicators is to check whether diversification was different across trade flows within Mercosur and with the rest of the world. If this is so, part of the overall diversification process could be attributed to the increase in regional trade. Figure 4.4 shows Theil concentration indexes for Argentina’s exports.

Exports to Mercosur are less concentrated than those to the rest of the world. On the import side (not shown), imports coming from the rest of the world are more diversified. Regarding the dynamics of the concentration indicators, the export indicator for Mercosur behaved more erratically compared to the export indicator corresponding to the rest of the world. More important, export diversification within Mercosur increased over time, though some diversification occurred even before 1991. This may reflect that on the export side considerable market access was obtained prior to 1991 through the partial agreements signed among Argentina, Brazil, and Uruguay. On the other hand, import concentration declined significantly after 1991, showing the effect of across-the-board regional (and unilateral) trade liberalization that has taken place since that year.

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**TABLE 4.3**

*Indicators of Trade Concentration, Argentina and Uruguay, 1986–99*

<table>
<thead>
<tr>
<th>Year</th>
<th>GINI</th>
<th>THEIL</th>
<th>GINI</th>
<th>THEIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>0.76</td>
<td>1.2</td>
<td>0.89</td>
<td>2.0</td>
</tr>
<tr>
<td>1992</td>
<td>0.64</td>
<td>0.8</td>
<td>0.86</td>
<td>1.7</td>
</tr>
<tr>
<td>1999</td>
<td>0.64</td>
<td>0.8</td>
<td>0.83</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**TABLE 4.4**

*Issues in R&D Incentive Policies*

<table>
<thead>
<tr>
<th>Issues</th>
<th>Tax Credit</th>
<th>Cost-Sharing Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fiscal impact</td>
<td>Possibly equivalent</td>
<td>Possibly equivalent</td>
</tr>
<tr>
<td>2. R&amp;D expenditures</td>
<td>Possibly equivalent</td>
<td>Possibly equivalent</td>
</tr>
<tr>
<td>3. Composition of investment</td>
<td>100 percent privately determined</td>
<td>Shared decision</td>
</tr>
<tr>
<td>4. Monitoring and administrative responsibility</td>
<td>Tax collection agency</td>
<td>Special public institutions</td>
</tr>
<tr>
<td>5. Challenges</td>
<td>Tax evasion, complex tax structure</td>
<td>Rent-seeking for subsidies, public sector’s decisionmaking ability, institutional overload</td>
</tr>
</tbody>
</table>

The evidence for Uruguay (see Sanguinetti, Pantano, and Posadas 2001a) shows that on the export side we also observe a greater level of diversification of those going to Mercosur. The differences in the level of the concentration indicators across destinations seem to be less significant (and have declined over time) than those found for Argentina. Still, when we calculate the Herfindahl concentration index (see Figure 4.5) the data show a significant and relatively stable difference in export concentration where those geared to Mercosur are less concentrated than those going to third markets. The remaining issue is how Mercosur aided trade diversification.

**Regional Integration, Economies of Scale, and Transport Costs**

In relatively small countries it will not be profitable to produce goods subject to large economies of scale. This could be because of lack of inputs or because the local market is
too small to achieve the required amount of sales to cover costs. Regional integration agreements (RIA) can help overcome this scale problem as local markets are pooled into a single larger market (see World Bank 2000 and Corden 1972). Thus, once countries form an RIA and the domestic market expands, new products subject to economies of scale will be produced.

The question that arises here is whether this inconvenience of smallness can also be overcome with general, non-preferential trade liberalization. Under what circumstances is this argument about economies of scale stronger for regional integration compared to unilateral trade liberalization? Three types of arguments can be made. First, unilateral liberalization does not ensure access to export markets, though it stimulates efficiency in domestic production, and in this respect it encourages exports. Reciprocity, on the other hand, is a key aspect of regional liberalization, and because of this it could be an effective tool to gain access to other markets.

A second related argument in favor of an RIA is that regional integration may enhance and protect market access. The multilateral trading system is still far from
assuring market access. Contingent protection is pervasive throughout the world, and neither protection in the form of antidumping safeguards nor other border frictions can be completely avoided. Regional integration could provide a WTO-plus environment where free trade within the regional markets is more sustainable and less subject to this contingent form of protection. The case of the European Union with the Single Market Program of 1989 is a clear example of a regional integration scheme where deep integration has been pursued. Even Mercosur has established a WTO-plus environment in some areas of trade policy. For example, safeguard actions are not allowed within the region.\textsuperscript{11}

Finally, another aspect in which an RIA can facilitate trade within the area, relative to that with the rest of the world, is by encouraging cooperation among countries in the area of physical integration. This could produce a significant reduction in transport costs, especially in the case where the countries that formed an RIA share common borders. For some products, this reduction may imply that these goods are traded within the region but not with third markets. Examples of these products are electricity, natural gas, and cement, all of which are typically subject to economies of scale in production.\textsuperscript{12}

\textbf{Regional Tariff Preferences: Diversification Through Trade Diversion}

Regional integration will change relative prices in member countries. Imports from partners become cheaper due to the elimination of tariffs. This in turn affects import demand and as a consequence affects trade flows and production. As indicated previously, the presence of tariff preferences may foster local production and exports of products that could not have been exported under a nonpreferential liberalization. Thus part of the diversification of exports we observe may be a consequence of trade diversion. However, it is also possible that RIAs might become platforms for world exports under certain circumstances. This possibility and new empirical evidence is discussed in Box 4.4. The following paragraphs review empirical evidence concerning the question of whether Mercosur helps explain the export diversification trend experienced by Argentina in the 1990s.

\textbf{Empirical Evidence}

Sanguinetti, Pantano, and Posadas (2001a) present the statistical results for Argentina covering 1991 to 1995. The authors assessed the impact of Mercosur on export concentration. In this case the dependent variable is the change in Argentina’s export shares to Brazil relative to Argentina’s export shares to the rest of the world. This analysis focuses on whether Mercosur helped Argentina diversify by allowing exports of new products to Mercosur but not to the rest of the world, either through trade diversion or economies of scale. Thus it is qualitatively different from the analysis in Box 4.4, which focuses on whether Mercosur allowed its members to export new products to the world after exporting them to Mercosur. Additional exercises presented in Sanguinetti, Pantano, and Posadas (2001a) considered alternative periods.

All the econometric evidence discussed by Sanguinetti, Pantano, and Posadas (2001a) shows that tariff preferences had a significant effect on the share of Argentine exports to the region (Brazil) compared with the rest of the world. The net effect of tariff preferences on Argentine export shares to Brazil is positive and significant, while the same preferences have had a negative and significant effect on export share of the same items to the rest of the world. Thus, as expected, tariff preferences have encouraged exports of certain items to Mercosur markets relative to extra-Mercosur destinations.

The evidence concerning the role of economies of scale in Mercosur is more ambiguous, suggesting that, contrary to what was predicted by theoretical arguments, sectors subject to larger economies of scale have expanded their exports to the rest of the world relative to Mercosur. This result is nevertheless not robust to small changes in the period of analysis (1992 to 1995 and 1992 to 1996). Thus, we should interpret this result with caution.

Overall, we conclude that tariff preferences played a positive role in encouraging Argentine exports to the region. However, the empirical models, and in particular the tariff preference margins, explain a small proportion of the variation across exports of the share going to Mercosur relative to the rest of the world. Thus other factors not contemplated in the aforementioned empirical analysis may have played a key role. Within those, we suspect that transport costs are relevant.\textsuperscript{13} In addition, most of the diversification of Argentina’s and Uruguay’s exports occurred within sectors. Hence the removal of the anti-export bias brought by the unilateral trade liberalization is probably the main driving force of trade diversification in these economies. Mercosur helped a bit, but the action was elsewhere.
Supporters of regional integration often argue that the formation of a larger market may serve as a platform for exporters to world markets (Devlin and French-Davis 1999). The region can serve as a “classroom” for potential exporters, where they can learn “how to export” and create a reputation as reliable suppliers. The knowledge acquired in the regional market can then be used to penetrate more distant markets outside the regional agreement. The regional market not only allows for the exploitation of economies of scale and learning by doing, but information about customs procedures, required design of export products, foreign consumer tastes, and firm reputation are generated through exports to the regional market.

Nicita, Olarreaga, and Soloaga (2001) explore the effect that regional exports within Mercosur had on the ability of members to export manufacturing products to the rest of the world. From a policy perspective, the presence of platform effects may create sufficiently large gains to compensate for potential trade diversion associated with preferential market access.

Information flows to other countries on regional exporter performance in other Mercosur markets are captured by weighting the evolution of exporter market share in the regional market by the bilateral share of trade in newspapers and periodicals (for example, Journal of Commerce, Export Channel, Made for Export, Gazeta Mercantil) between Mercosur members and each rest-of-the-world market.

After controlling for potential information flows among rest-of-the-world countries on the export performance of Mercosur members in their respective markets, there is no evidence of a platform effect associated with the creation of Mercosur in 1991 at the aggregate level. However, in the case of the small members of Mercosur (Uruguay and Paraguay), there is evidence of export information spillovers in the regional markets, but also in the rest of the world, before and after the creation of Mercosur in 1991. This suggests that the tariff preferences granted from 1991 onward had little effect on their availability to penetrate other foreign markets. Exporters in Paraguay and Uruguay benefited from export information spillovers, regardless of the creation of Mercosur.

On the other hand, at a more disaggregated level (SITC 1 digit), there is evidence of platform effects for all Mercosur member exporters. Argentina’s exporters of chemicals (SITC 5) and machinery (SITC 7) have taken advantage of their increase in exports to the regional market, after the creation of Mercosur in 1991, to improve their performance in rest-of-the-world markets. The same is true for Brazilian and Paraguayan exporters of basic manufacturing (SITC 6: textiles, wood, paper, and leather) and for Brazilian and Uruguayan exporters of machinery.

Moreover, there is also evidence for the small members of Mercosur (Paraguay and Uruguay), both at the aggregate and disaggregated level, that they have benefited from other Mercosur member export performance in rest-of-the-world markets. Since the creation of Mercosur, improvements of other Mercosur member export performance in rest-of-the-world markets has helped exporters in Paraguay and Uruguay increase their exports to the rest of the world in all industries, except for basic manufacturing in Uruguay and other manufacturing (SITC 8: apparel, footwear, instruments, and furniture) in Paraguay. For example, exporters of Uruguayan machinery to the rest of the world have therefore benefited from better export performance of Brazilian exporters of machinery in those markets.

In sum, although platform effects are not generally present across all industries for Mercosur exporters, there is evidence that exporters in different Mercosur countries have benefited from platform effects associated with the creation of Mercosur in at least some industries. Since 1991 exporters to the rest of the world in Paraguay and Uruguay have also benefited from large Mercosur member export performance in those markets. However, note that whether these platform effects dominate the trade-diverting effects associated with preferential access behind (high) external tariffs remains an open question.

Brazil’s Reforms, Manufacturing Productivity, and EMBRAER

As shown, the economic reforms undertaken in the past decades in Latin America had significant impacts on the productivity and export performance of the agricultural sector. This was also the case in manufacturing. In this section, we first review the evidence on the turnaround in Brazilian manufacturing productivity during the 1990s. We then look in detail at the case of EMBRAER, the Brazilian aircraft manufacturer that in recent years has become a commercial success.

Productivity Growth in Brazilian Manufacturing: Review of the Evidence

Although estimates of productivity vary considerably with the specific methodologies adopted, and with the source and level of aggregation of the data, all the available studies indicate a considerable improvement in Brazilian productivity during the 1990s. At the aggregate level, studies performed at Brazil’s Central Bank and Planning Ministry find increases of annual productivity growth from the 1980s to the 1990s of, respectively, 2.7 percent and 1.1 percent. World Bank estimates suggest an increase of 1.9 percent (see Teixeira da Silva 2001, Bonelli and Fonseca 1998, and Loayza 2001).

As expected, the improvements were even larger in the manufacturing sector, where exposure to import competition is greatest. Although the estimates also vary considerably depending on the level of aggregation of the data, studies performed on the basis of industry-level figures suggest increases of around 4.5 percent from the 1980s to 1990–97. Also, the efficiency gains of Brazilian manufacturing firms were reflected in considerable reductions of their markups during the 1990s. From 1990 to 1995, the difference between real prices and costs fell by 21.1 percent in the Brazilian manufacturing sector, while another 5.3 percent reduction occurred during 1995–98 (see Moreira 2000).

The pressure to increase efficiency came from the unprecedented access of Brazilian consumers to imported goods, as nontariff trade barriers were mostly eliminated and tariffs were reduced to almost one fourth of their previous average. Also, as part of the successful inflation stabilization policy implemented in 1994, the real exchange rate experienced a significant appreciation during most of the decade, which further stimulated imports. In this context, cost-reducing and quality-increasing strategies became a necessity for the survival of Brazilian manufacturing firms. However, it is very important to remember that the real appreciation of the real was also associated with extremely high interest rates and with low aggregate economic growth rates. Thus, the real exchange rate appreciation was not good for the economy as a whole.

The opening of the economy also provided new means for efficiency improvement. After decades of limited access to state-of-the-art equipment, components, and technologies in general—whenever a product had a “national similar” its imports were automatically prohibited—Brazilian firms gained access to the same suppliers used by their foreign competitors. Thus, effective rates of protection diminished at an even faster rate than nominal tariffs, and imports of intermediate and especially capital goods reacted to the opening of the economy more rapidly than those of final products.

Although the timing of the productivity turnaround coincided with the adoption of trade liberalization, its underlying causes have still been the subject of some debate. Indeed, it has been argued that part of the productivity growth recovery could be associated with cyclical factors, particularly the deep recession that followed Brazil’s failed attempts at stabilization during 1990 and 1991. This argument, however, has been overtaken by the fact that productivity increases have persisted during the periods of output growth after 1992. Moreover, the basic result of a significant turnaround in productivity growth appears to be robust to the use of different data sources and the particular approach adopted to measure the services of labor and capital—including therein different measures of capacity use, data on electricity consumption, corrections for unemployment, hours worked, and so forth.

Finally, econometric estimates confirm a positive impact of trade liberalization on the level and growth of manufacturing productivity. For instance, studies performed using firm-level data suggest that both the level and the rate of growth of TFP were significantly associated with reductions in tariffs and with real exchange rate appreciations (see Hay 1997 and Muendler, Sepúlveda, and Servén 2001). Similar conclusions are obtained with data tabulated at the industry level, which also suggests a positive association between the degree of import penetration and the rate of industry TFP growth (see Rossi Júnior and Ferreira 1999).
**Brazil’s EMBRAER**

Chapter 2 discussed the recent evolution of the structure of Brazil’s net exports. It is clear that the country maintains a comparative advantage in a variety of products, ranging from tropical agriculture to capital-intensive manufactures. However, the behavior of net exports of machines since the early 1990s indicates that the only sector in which Brazil maintains a notable comparative advantage is in the export of transport equipment (excluding road vehicles), especially aircraft. The Brazilian company EMBRAER, the relatively successful firm that produces small airplanes, is an example.

In June 1999, at the Paris Le Bourget air show, EMBRAER announced sales of 200 commuter jets, with contracts totaling US$6.6 billion. During 1999, EMBRAER’s sales of US$1.9 billion made it the fourth-largest aircraft manufacturer and the second-largest in the market for regional jets, with net revenue of US$230 million. The excellent recent performance of EMBRAER is even more impressive if one considers the fact that at the beginning of the 1990s the formerly state-owned Brazilian company was on the brink of bankruptcy.

In December 1994 the company was bought by a consortium led by a local financial conglomerate. The government assumed the company’s debt and reduced its ownership to 6.8 percent. The new management implemented a thorough reengineering process, and gave full priority to the project of the ERJ-145, a 50-passenger jet that was already at the end of the development process, and the sales of which would later be responsible for the company’s reversal of fortune. However, a complete explanation of the company’s recent performance has to contain at least two other important dimensions.

First, EMBRAER benefited from substantial government support, including but going far beyond the export subsidies that are now the focus of an ongoing dispute between Brazil and Canada at the WTO. Second, the company’s commercial success in the global market for regional jets cannot be dissociated from the knowledge and skills accumulated by EMBRAER over the years, related to the company’s early foreign market exposure, associated with its export orientation and the coupling of high R&D investments with strategic partnerships with foreign manufacturers.

As for the government policies used to support EMBRAER, it must be emphasized that the company benefited from much more than the current subsidized credit lines. EMBRAER’s initial projects, staff, and equipment were absorbed, at no cost, from other Air Force–related institutions. The government also designated to EMBRAER a fraction of the income tax paid by all companies established in the country, a transfer which amounted to US$500 million between 1969 and 1985. Other benefits include the exemption of import, export, sales (ICM), and industrial products (IPI) taxes, import protection, large orders from Ministries of Aeronautics and Agriculture, government loans and grants, and the support of Brazilian diplomacy in international sales, especially in the military market.

It must be noted that in an oligopolistic market such as the one for commuter aircraft, governments may have incentives to pursue strategic trade policies, in order to shift profits from foreign to domestic firms. However, although there is evidence that this has in fact been a common practice in that market, welfare gains from government interventions of this type are not guaranteed, especially if possible retaliation is taken into consideration (see Baldwin and Flamm 1989).

As for EMBRAER’s particular market strategies, one of the most important is the company’s early focus on reaching foreign markets as opposed to concentrating on Brazil’s protected local market, as many other manufacturing companies in that country did. For instance, EMBRAER’s first important product, the 19-passenger turboprop EMB-110 or Bandeirante, was first delivered in 1973 to the Brazilian Air Force, and in 1979–82 it had already attained a 32 percent share of the U.S. market for 15- to 19-passenger aircraft. The Brasilia, a 30-passenger, twin-engine turboprop first delivered in 1985, reached market shares of 25 percent worldwide and 29 percent in the United States. Thus, in the early 1980s, EMBRAER’s ratio of exports to production was already close to 50 percent, increasing to more than 60 percent at the end of that decade. After its recent comeback, EMBRAER’s exports reportedly represent 95 percent of total sales.

EMBRAER also differed from the typical import-substitution-driven company in that it avoided any attempt to reach high degrees of local content in its products. This option, it must be noted, was not available to most Brazilian industries, which were subject to domestic content laws that forced them to use domestic suppliers for inputs. During the 1980s, the ratio of imports to production was close to 50 percent, and it has increased in recent years, reaching 62.4 percent in 1999. In fact, almost all the key components and systems in EMBRAER’s planes, such as...
were a clear commercial success. Internal spillovers, generating knowledge and skills on loans. Although all projects were the source of important debtedness, in addition to the commercial failure of some of the military planes, three of the five main projects of this period were targeted primarily at the civil market, and were financed with the company’s own resources and commercial loans. Although all projects were the source of important internal spillovers, generating knowledge and skills on which successive planes would be based, only two of them were a clear commercial success—the Tucano and the Brasilia. The development of a sixth plane was started in the late 1980s—the EMB-145—but the company’s excessive indebtedness, in addition to the commercial failure of some of its products, and a softening of the international aircraft market, led to delays in the project.

Production of the EMB-145 began during EMBRAER’s third phase, after its privatization. Among the changes introduced by the new management must be emphasized the shift from an engineering-driven to a market-driven strategy. Indeed, among the planes developed by EMBRAER, the three main commercial failures were characterized by being overpriced for their market segment, even though all were technical successes with good operational records. Moreover, especially during the late 1980s, the company opted for an expansion of its product line by engaging in technically sophisticated expensive development projects at a time when its financial structure was already fragile. This type of decision would probably not be made by the new private controllers, committed to the profitability and financial sustainability of their investments.

The new phase has also been characterized by the use of risk-sharing partnerships, four in the case of the EMB-145, and 10 in the case of the new ERJ-170/190 family. Another important partnership was created in November 1999, when a French consortium including Aerospatiale-Matra, Dassault Aviation, Thompson-CSF, and Snecma bought a 20 percent stake in EMBRAER. Among other gains, this new partnership is expected to improve the company’s access to international financial markets, and to contribute to its expansion in the military and in foreign markets in general. For the French companies, the partnership with EMBRAER could probably increase their odds of being selected as suppliers of the Brazilian Air Force in its forthcoming new round of equipment procurement (see Goldstein 2000 and Bernardes 2001).

It is important to note that a rigorous cost–benefit analysis of Brazil’s commitment to the development of EMBRAER is hampered by the difficulties in quantifying the numerous benefits that the company received from the Brazilian government. However, it is clear that the total amounts involved are very large, because they cover a variety of government policies: the provision of specialized human resources, preference in government procurement to the company or its partners, direct transfers of tax revenues and capital injections in general, a variety of tax exemptions, subsidized credit, and import protection, among others.

The total opportunity cost of the above resources should be weighted against the social benefits derived from EMBRAER’s establishment and growth, including the

engines and avionics, are purchased from foreign-based suppliers: 95 percent in the case of the ERJ-145 program and 85 percent for the ERJ-170/190 family of 70-to-108-passenger jets, whose initial deliveries are expected for 2002. As a consequence of EMBRAER’s early focus on international sales, the company has been an important contributor to Brazilian exports. However, because of its intense use of foreign inputs, the company’s net export performance has been less impressive, especially if one takes into consideration that its local suppliers also tend to have a large import-to-production ratio. For instance, it has been estimated that between 1975 and 1988, EMBRAER’s net exports averaged US$123 million per year. But average net exports in that period shrink to less than US$20 million when an adjustment is made to consider imports by EMBRAER’s suppliers (Dagnino 1993:54).

As for EMBRAER’s technological strategies, one could distinguish three phases in its history of product development and manufacturing (Frischtak 1993, 1994). The first was characterized by the manufacturing of products developed outside EMBRAER, either by the Air Force’s Centro Técnico da Aeronáutica (CTA) or by foreign companies. It is a period of intense learning in production technologies, and in the areas of marketing and customer technical assistance. A crucial role was played by the knowledge absorbed from foreign companies that partnered with EMBRAER during this period. Those important agreements, with Aermacchi, Northrop, and Piper, were made possible by the intervention of the Brazilian government, which in practice used them as conditions to gain access to the Brazilian civil and military markets.

A second phase started in the late 1970s and lasted until the company’s privatization in 1994. It was characterized by the development of in-house formal R&D activities, which generated a series of increasingly sophisticated planes. While EMBRAER still counted on government finance for the military planes, three of the five main projects of this period were targeted primarily at the civil market, and were financed with the company’s own resources and commercial loans. Although all projects were the source of important internal spillovers, generating knowledge and skills on which successive planes would be based, only two of them were a clear commercial success—the Tucano and the Brasilia. The development of a sixth plane was started in the late 1980s—the EMB-145—but the company’s excessive indebtedness, in addition to the commercial failure of some of its products, and a softening of the international aircraft market, led to delays in the project.

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The total opportunity cost of the above resources should be weighted against the social benefits derived from EMBRAER’s establishment and growth, including the
externalities or spillovers reaped by other companies, and EMBRAER’s contribution to Brazil’s balance of payments, given its focus on international sales. Although these benefits are difficult to quantify, the fact that EMBRAER has concentrated on system-integration activities and maintains a low degree of indigenous content in its products, suggests that at least in terms of net exports, and the development of specialized local suppliers, the company’s contributions have been limited.

More indirect spillover effects were probably significant at the local level because EMBRAER, together with CTA and the Instituto Tecnológico da Aeronáutica (ITA), reportedly contributed to the transformation of São José dos Campos, from a relatively small city in the 1950s, to a prosperous industrial center with a population of a half-million today. It must be noted, however, that significant local investments by multinationals in the automobile and consumer goods industries had already taken place before the establishment of EMBRAER in 1969.

In sum, much of the current market success of EMBRAER is related to its early exposure to foreign markets, both through its export orientation, and in terms of its strategy of combining high R&D investments with imports of foreign inputs and know-how, and strategic partnerships with foreign companies. However, although EMBRAER successfully developed into a world-class manufacturer of technologically sophisticated products, the costs involved in its development were enormous, and we do not know whether the company could have succeeded without substantial government support. Moreover, it is not clear that the net present value of the public investments made in EMBRAER are positive, even considering its recent commercial success. For instance, due to the company’s focus on system integration and its limited use of local suppliers of inputs and components—both important aspects of its market and technology strategies—EMBRAER’s interaction with local industries has not been significant, so that knowledge and technology spillovers have probably been limited. Even if the company has been a significant contributor to Brazilian exports, its net exports have been much more limited due to the fact that EMBRAER’s imports have also been considerable. Finally, it must be remembered that the effectiveness of credit or other types of subsidies directed at shifting profits from foreign firms to EMBRAER is limited by the possible retaliations that those measures may trigger.

Exports and Foreign Investment in Central American Countries: Tax Incentives, Institutions, or Human Capital?

Over the last decade, Costa Rica and El Salvador experienced exceptional economic growth. In both cases, the expansion of exports—in particular those from EPZs—suggests that foreign investment and exports played a major role in fostering growth. Nevertheless, the profile of exports and dynamic sectors differs substantially across the two countries, suggesting that their future development paths will be quite different. Most notably, the types of technologies being adopted are considerably distinct.

This case study examines the policies implemented in these countries, and the challenges that must be faced. The study starts by describing the recent economic performance of the two countries. It then investigates the determinants of the different composition of exports and foreign investments between Costa Rica and El Salvador during the 1990s. The much higher stock of human capital in Costa Rica seems to explain why the more technologically advanced foreign investments chose Costa Rica as opposed to other countries in the region. To explore this view, the study looks at the explanations provided by firms about their decisions to locate in Costa Rica.

Exports and Growth During the 1990s in Costa Rica and El Salvador

Like all Central American economies, Costa Rica and El Salvador experienced dramatic events during the 1980s. Costa Rica initiated the decade with a balance-of-payments crisis triggered by large internal and external macroeconomic imbalances. The stabilization required a large devaluation, as well as fiscal and monetary tightening. The fixed exchange rate regime was abandoned, and a more flexible crawling peg was adopted, together with other structural adjustment measures.

In the 1990s, all the economies in Central America, starting at different times and at different rates, embarked on a process of liberalization of markets, reduction of import protection, reduction of the size of the public sector, and incentives to exports. With macroeconomic stability in place, the scenario was remarkably different, and long-term development objectives were again a top priority. Like in the 1960s and 1970s, policy focused on how to speed up growth. The goal was now sought through exports of new goods to new markets and through foreign investment.
Both Costa Rica and El Salvador grew remarkably fast during this period, with per capita GDP average annual growth rates of 6 percent and 7.7 percent, respectively. To put these numbers in perspective, Costa Rica expanded its GDP by 78 percent, and El Salvador doubled its GDP during the period. The yearly aggregate exports of both countries during the decade grew even more dramatically, doubling for Costa Rica and more than tripling for El Salvador. The ratio of exports to GDP for both countries grew significantly over time, most notably in the second half of the 1990s.

The expansion of exports was not concentrated in traditional goods, nor was it the result of favorable movements in world prices. On the contrary, the expansion of exports was concentrated in new sectors, which changed the configuration of the two economies. To illustrate how fast the change took place, Figures 4.6a, 4.6b, 4.7a, and 4.7b display the average composition of the exports during 1995–96 and 1999–2000 for both countries. Clearly, the importance of the traditional goods—coffee for El Salvador, and coffee and bananas for Costa Rica—decreased.

Though part of the decline in the share of traditional goods was due to new producers in the international markets and increased protection from developed countries, mainly the European Union, part was also the result of the development of EPZs. For El Salvador, the share of exports out of EPZs, mostly maquilas, increased from 41 percent to 54 percent in less than five years. For Costa Rica, this same share went from 27 percent to 58 percent. For Costa Rica, such an impressive growth was in great part due to the initiation of operations of Intel and other high-tech firms in the country (Remec, Sawtec, Cinair, and Sensortronics, for example).

The rising importance of EPZs in both countries is illustrated in Figure 4.8, which displays total exports and imports of firms in EPZs, and Figure 4.9, which shows the fraction of the total gross and net exports generated by EPZs. Here, the net series is constructed by removing the imports made by firms in EPZs, that is, \((\text{Exports}_{\text{EPZ}} - \text{Imports}^{\text{EPZ}})/(\text{Total Exports} - \text{Imports}^{\text{EPZ}})\). The importance of EPZs in gross export and import flows accelerated at the end of the 1990s. Furthermore, EPZs were not simply increasing both gross exports and imports, since the ratio of net exports more than quintupled for Costa Rica and almost tripled for El Salvador, in less than five years.

There is little doubt that forces working throughout the period—such as the political and macroeconomic stabilization in the region, the worldwide movement toward free trade, and the formation of trade blocks—would have increased the flows of foreign investment to the region, and the exports of maquila and other products. It should be noted that in several countries, notably in the Caribbean, rapid advances in information and communications technology have also added impetus to the development of new export activities in EPZs (see Box 4.5). However, governments in both Costa Rica and El Salvador actively promoted the development of EPZs.

**Tax Incentives in EPZs: Inevitable Reforms in the Future**

Both Costa Rica and El Salvador provide significant benefits to the establishment of export-oriented firms in their
And, despite the fact that most of the established firms are foreign owned, this specific set of incentives is directed to exports, independently of nationality. Nevertheless, both countries also have incentives directly aimed at foreign investors. Table 4.5 compares the incentives provided by Costa Rica and El Salvador as of 2001. It is clear that the incentives are biased toward export-oriented markets, in sharp contrast with the incentives from the import-substitution schemes of the 1960s and 1970s.

Costa Rica and El Salvador offer similar incentives. There are no restrictions on the repatriation of profits or remittances, no import or exports taxes, and no sales taxes as long as the goods are sold abroad. However, there are important differences. On one hand, El Salvador is more generous with fiscal incentives. In every tax dimension explicitly mentioned, El Salvador offers either a larger benefit or a longer duration. Costa Rica, on the other hand, seems more proactive in terms of providing assistance with training of the labor force. Also, in Costa Rica the benefits seem to target employment in underdeveloped regions, but those are additional benefits, not requirements.

While it is difficult to assess the actual effectiveness of these benefits, it would be extreme to think that they have been redundant. Figure 4.10 displays the FDI received by the two countries during the 1990s. It is obvious that they have grown dramatically. After a slow start, especially for El Salvador, the flows of FDI accelerated during the second half of the decade. Figure 4.10 also shows the large difference between Costa Rica and El Salvador in the volume of investments. Until 1996, FDI in El Salvador was negligible. Costa Rica, on the other hand, has consistently received large inflows and, apart from an expected slowdown during 1998–2000, the FDI flow increased steadily. Only in 1998 did El Salvador receive more FDI than Costa Rica, but even that cannot be taken as a signal of reversion because it was mostly due to the large privatizations taking place in El Salvador. In 1998 and 1999, El Salvador successfully privatized four electricity distribution companies, three thermal generation plants, and the national telephone company (which was split in two). The sum of these operations amounted to almost US$1 billion.

A common feature of the EPZs in these countries is the use of tax incentives to promote foreign investment. This is also true for EPZs in the Caribbean. In the case of the Dominican Republic, Law 8-90 permits a maximum of 20 percent of production to be sold in the local market. These types of export requirements will become illegal under the WTO framework by January 2003. Hence the aforementioned countries, as well as others in the LAC region, will need to make reforms to bring their incentive systems within the WTO’s legal framework. Efforts are under way to raise the income-per-capita criteria used by the WTO to provide exemptions to this rule. But if these efforts fail, these countries will need to change their incentive structure.

More specifically, the relevant authorities should consider reducing corporate income tax rates to low levels for all firms, which should continue to attract FDI. This approach is now favored by Costa Rica. The main advantage of this solution is its simplicity, because the corresponding tax system is significantly simplified, thus reducing the costs (evasion, etc.) associated with complicated tax structures. On the other hand, this approach requires a substantial amount of regional coordination among Central American and Caribbean countries to prevent a race to the "bottom" in terms of tax rates, which could cause fiscal difficulties.
Another alternative is to remove the export requirements and replace them with criteria permitted by the WTO, such as objectives for developing marginal geographic areas, or employment generation could also help stimulate future investments. The disadvantage of this set of incentives is that dynamic firms might not be attracted to those areas precisely because high-tech firms usually look for locations where there are other similar plants to take advantage of any knowledge externalities.

In the meantime, efforts at the regional level should coordinate the implementation of such changes to prevent investment diversion and a race to the bottom (in terms of providing more and more onerous fiscal incentives for firms) among LAC countries. We believe that making such a
For the countries that manage to successfully participate in the new knowledge-based economy, the development of the ICT sector is the source of dynamic economic opportunities. With the development of the Internet and the dramatic reduction in telecommunications costs, the diffusion of ICT has accelerated.

Confronted with the persistent decline of their traditional primary exports, countries such as Barbados, Jamaica, and Trinidad and Tobago have visualized the ICT sector as the source of significant opportunities for export diversification, and for the attraction of FDI. Local authorities have made developing an export-oriented information services sector one of their top priorities, and have implemented a series of policies to that end.

Because comparative advantage in information services is crucially related to the availability of a labor force with the appropriate skills, and to a good telecommunications infrastructure, important efforts have been devoted to improving local conditions in those two areas. In addition, new policies have been implemented to advance the relevant institutional setup, including the creation of new investment promotion agencies, EPZs, and industrial parks; strengthening intellectual property rights; and establishment of venture capital funds directed at promoting new technology-based companies.

In education, measures have been taken at different levels to adjust the supply of skilled workers to the needs of the newly established sector. The measures include strengthening the information technology component of primary and secondary education, and making changes in the curriculum and degrees offered by graduate and undergraduate university programs, notably in Jamaica’s University of the West Indies, which is considering establishing a science park.

Interestingly, some of the main initiatives in the area have been led by the private sector. In Jamaica, for instance, a successful in-house training program developed by a software firm, that was intended to prepare software programmers for the company, was eventually franchised to the island’s second main university, the University of Technology. With this collaborative framework, supported by the government educational and export promotion agencies, the originally private training program will be applied in other institutions across Jamaica. Cooperative arrangements between universities and private companies are also found in Barbados, where the local University of the West Indies has had fruitful collaborative partnerships with information services firms.

In the field of telecommunications infrastructure, local governments have recognized the fact that the activities of businesses in the information technology sector increasingly rely on the movement of large amounts of data, so that the provision of modern and competitive telecommunications services is crucial for their development. Thus, both Barbados and Jamaica have embarked on telecommunications reform programs intended to assure the provision of competitive, state-of-the-art services such as low-cost broadband capacity at special rates for information services companies.

As a result of the attractive conditions offered to information services companies, some Caribbean countries have been able to attract a considerable number of investors in areas such as customized software development, industrial design, telemarketing, data entry, and multimedia. These firms comprise both foreign, but also increasingly domestic, firms. The number of such companies entering the offshore information services sector has grown exponentially, particularly during the 1990s. In 1997 they employed 3,000 workers in Barbados, or 2.5 percent of the workforce. In Jamaica’s Montego Bay Freezone, for example, in 2000 those companies employed 4,500 employees, surpassing employment in the declining manufacturing industry.

It is important to note that some characteristics of Barbados and Jamaica provide additional incentives for FDI that are not necessarily met in other Latin American or Caribbean countries. For example, these countries have some of the highest teledensities in the world; labor forces are literate and English speaking; labor costs are comparatively low, including benefits; and these countries have geographic proximity to the large North American market. However, in many respects the experience of these Caribbean countries is illustrative of the challenges and opportunities involved in the development of the information services sector.

transition should not be costly from a developmental viewpoint, because the main benefits of these zones for foreign investors are the establishment of transparent institutions safeguarding the property rights, and the geographic location and skills of the local labor force. Yet human capital played a key role in determining the structure of FDI in Costa Rica.

**FDI and High-Tech Firms in Costa Rica:**

**The Roles of CINDE and Human Capital**

In 1996, Intel decided to locate a plant in Costa Rica, and the plant was built in approximately two years. Why did Intel choose Costa Rica? The Costa Rican government offered an attractive set of incentives, such as subsidies on electricity and several tax exemptions. But other countries, such as Brazil, Chile, El Salvador, Indonesia, Mexico, the Philippines, and Thailand, competed with similar incentive packages. Indeed, at the beginning of the selection process by Intel executives, Costa Rica was not even considered a serious candidate. The usual argument is that the final decision was based on the combination of geographical proximity to the United States and internal labor market conditions—with political stability and the quality of the labor force being highlighted. While Intel is the most commonly mentioned high-tech firm installed in Costa Rica, it is not the only one. Recently, other technology firms, such as Procter and Gamble, Roche, and Abbott Laboratories, also started operations in the country.

It is true that Costa Rica has been more politically stable than most Latin American countries. However, it is not clear that high-tech firms are particularly vulnerable to expropriation or other forms of political risks. On the contrary, the high-tech sector seems to be less sensitive to the risk of expropriation, since the main source of value is the know-how and human capital of the managers.

An important factor that helped attract FDI to Costa Rica was the role of the CINDE, a private nonprofit orga-
nization. It was founded in 1983 by prominent businesspeople, supported by the Costa Rican government, and financed by grants from the United States Agency for International Development (USAID). Its broad mission was to help in the development of the economy, but the attraction of FDI was always one of its top priorities. In the early 1990s CINDE realized that the country was losing competitiveness in unskilled-labor-intensive industries to other members of the CBI and also due to the prospects for NAFTA, which would give Mexico better access to the U.S. market than beneficiaries of the CBI. At the same time, CINDE was losing the USAID funding it had enjoyed since its creation. Given these circumstances, it decided to focus its FDI attraction efforts on fewer sectors, choosing the ones that were a better match for Costa Rica’s relatively high education levels (that is, skilled-labor-intensive industries).

For the strategic plan of 1993, CINDE focused on sectors associated with the electrical, electronic, and telecommunications industries. These sectors not only required more skilled workers, but were also experiencing fast growth in the United States, and strong competitive pressures were forcing companies to search for low-cost locations around the world. It was thought that these sectors were a particularly good match for Costa Rica, not only because of its high-quality public institutions, but also because of its supply of technicians and engineers at relatively low cost, and also because of the widespread knowledge of English. Moreover, there was a high quality of life, with good access to health services, nightlife and cultural amenities, and natural resources (for which the country was increasingly better known, given the ecotourism boom). By 1995, several high-tech multinational corporations (DSC Communications Corporation; Sawtek, Inc.; Merrimac Industries; and Remec) had set up plants in Costa Rica.

When word got out in 1996 that Intel was shopping for a new site, CINDE played a key role in attracting attention to Costa Rica, and essentially managed to get the country on the list of candidates. Not only was CINDE important in convincing Intel to consider Costa Rica as a possible location for its plant, but it was also extremely helpful to Intel in conducting its research and obtaining the credible and consistent information it demanded. Moreover, its links to and credibility with the government allowed it to play a key role in arranging successful meetings between Intel executives and government authorities.

Besides its support of CINDE, the government was very diligent in responding to Intel’s concerns in areas such as education, electricity, and taxes. The concessions made were not specific to Intel, but were generally applicable to other companies as long as they met the required conditions. In this sense, it could be argued that these were not concessions, but rather Intel-inspired reforms to improve the country’s performance. For example, the “concessions” included the addition of a one-year certificate program of education focused on technical skills and physics or chemistry competency, and a one-year associate degree program.

![Costa Rica and El Salvador: Net FDI](https://example.com/figure4.10.png)

**Figure 4.10**

Costa Rica and El Salvador: Net FDI

focused on semiconductor manufacturing. These reforms came from recommendations made by a special committee that was created for this purpose and was composed of, among others, the Minister of Education and the Minister of Science and Technology.23

While the activities of the government and CINDE were key, in what follows we explore further the role of the qualified labor force. Box 4.6 conducts a further statistical analysis that shows that the levels of FDI across LAC countries can be explained by differences in the levels of human capital.

The results of a survey from the Association of American Chambers of Commerce in Latin America on the quality of the labor force asked firms located in various countries in Latin America to rate, on a scale from 0 to 10, several aspects of the labor force in each country. Figure 4.11 shows the results of the survey in terms of two variables: productivity and speed of learning. The actual numbers should be interpreted with caution, because different industries may be located in the different countries, and sample sizes may vary significantly. Yet, these responses make a strong case in favor of the hypothesis that the labor force in Costa Rica compares favorably with other countries, even with the most advanced ones, such as Argentina and Chile. The results should not surprise those who are aware of the fact that Costa Rica consistently ranks at the

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**BOX 4.6**

**FDI and Human Capital in LAC**

In our discussion of the determinants of the magnitude and composition of exports and FDI in Costa Rica and El Salvador, we argued that human capital played a major role. Our view is that the quality of the labor force in the different countries determines the attractiveness of the country to foreign investors. A highly skilled labor force attracts capital in more dynamic, knowledge-intensive sectors, thus sustaining export dynamism and enhancing the prospects for economic growth.

Here we systematically investigate the relation between FDI and human capital for a group of 21 Latin American countries. We look at the relation between the 1990 human capital level of a country and the amount of net FDI received by that country (as a share of GDP) in the subsequent years. To check the robustness of the results, we use different human capital indicators and different time frames for the FDI. We also analyze the determinants of the net FDI received specifically from the United States, to check whether it is in any way different from the general pattern observed. The human capital indicators come from the Barro and Lee dataset, and they are the following, all for the population above age 15: percentage of secondary school attained, average schooling years, average years of primary schooling, and average years of secondary schooling. The periods of FDI analyzed are 1985–98, 1990–98, and 1985–98. The first set of results refers to simple regressions of the average FDI for these periods on the different indicators of human capital, and the second set includes additional controls in these regressions (the controls are output per worker and a CBI dummy variable). Results for the coefficients on the human capital indicators are summarized in Table 4.6.

The results show a consistent positive relation between initial levels of human capital and subsequent FDI. Most of the time, this correlation survives the inclusion of additional controls. The results imply, for example, that an increase of five years in the average level of education of the population above age 15 is usually associated with an increase in FDI of 3 percent of GDP. The results also suggest that the sensitivity of FDI to the initial level of human capital is even higher at higher levels of education (secondary), and that it increased significantly in the second half of the 1990s. The results for the United States share similar patterns, and FDI from this country seems to be even more sensitive to human capital levels. Overall, the evidence supports the point that human capital determines the amount of FDI received by a country. The role of education in spurring economic growth seems to go beyond the traditional view of enhancing productivity within given economic activities. Education can determine the prospects of the country in terms of access to technologies and development of new dynamic sectors.
TABLE 4.6
FDI as a Percentage of GDP and Human Capital Indicators in LAC Countries: Econometric Results

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<tr>
<td>Percent Secondary Attainment</td>
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<td>0.0938</td>
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<td>0.2823</td>
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<td>N obs = 21</td>
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MULTIPLE REGRESSIONS: INCLUDE OUTPUT PER WORKER AND CARIBBEAN BASIN DUMMY

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<td>Percent Secondary Attainment</td>
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<td>0.434</td>
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<td>0.351</td>
<td>0.2608</td>
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<td>1.5428</td>
<td>1.7927</td>
<td>1.57</td>
<td>1.5193</td>
</tr>
<tr>
<td></td>
<td>1.0538</td>
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<tr>
<td>N obs = 21</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Dependent variables are average level of total net FDI/GDP for the periods indicated, and average level of net FDI/GDP from the United States (1994–98). Independent variables are indicators of human capital for 1990. Controls included in the multiple regressions are: dummy for countries in the CBI and output per worker. Countries included in the total FDI/GDP sample are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, the República Bolivariana de Venezuela, Trinidad and Tobago, and Uruguay. Countries included in the U.S. FDI/GDP sample are Argentina, Barbados, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Panama, Peru, the República Bolivariana de Venezuela, and Trinidad and Tobago.

Source: Estimates by A. Monge (Northwestern University).

A survey on the labor market conditions faced by high-tech firms was conducted in 2000 by Promotora del Comercio Exterior de Costa Rica (PROCOMER), and asked 28 firms questions about the quality of managers, technicians, engineers, and skilled and unskilled labor, and questions on the quality of the training programs and curricula of existing educational institutions (technical and higher education). In general, the perception is favorable. Managers, engineers, technicians, and skilled and unskilled workers receive high marks in terms of productivity, speed of learning, and disposition to work variable shifts. Most notably, managers and engineers have the highest scores in terms of productivity, creativity, initiative, and speed of learning. The scores are relatively lower, but still not bad (above 8 out of 10), in terms of specific knowledge and skills for engineers. In this last dimension, technicians and skilled and unskilled workers have a more modest score, just above 6. This is not surprising, because this new industry requires activities to be performed by workers who did not have any previous experience. Another aspect worth mentioning is the gap in terms of English proficiency. Consistently, firms indicate that employees at all levels are not quite as fluent in English as would be desirable. English proficiency, however, does not really seem to pose a long-term problem because the industry of English as a second language has bloomed in Costa Rica. English has also been introduced in the national curriculum of primary schools in the whole country.
The PROCOMER survey also suggests that wages of high-skilled labor are attractive to foreign firms. It is well known that labor costs in Costa Rica are higher than in other neighboring countries. But, for any economic decision, the relevant consideration is the price of effective labor, that is, the cost of labor per unit of time versus its productivity. Interestingly, the firms in the survey generally do not find the costs of different workers in Costa Rica to be high: only 4 percent make that claim for engineers and managers, 12 percent for administrative staff and technicians, and 20 percent for skilled and unskilled workers. The general pattern is that the relation of productivity to cost improves with the level of human capital of the employee. Indeed, the responses of the firms in the sector suggest that there are significant cost reductions by operating in Costa Rica as opposed to the United States.

The two main educational institutions, the University of Costa Rica and the Costa Rican Institute of Technology, also receive good evaluations. The survey asked about the perception of the firms in relation to quality and appropriateness of the programs for their needs. While the adequacy of the curriculum for their specific needs was questioned, the quality of the two institutions received very good reviews. Table 4.7 reports the scores, in ascending scale from 0 to 10. Private universities and the public national university obtained significantly lower marks. Moreover, few enterprises in the survey indicated that they had hired professionals from the public university.

This group of firms has also needed to train its workers because of both the specific tasks required for each job and the newness of the sector in the economy. Most of the firms use the local plant or the headquarters of the company for training, and only 46 percent and 39 percent, respectively, use public and private local institutions (see Figure 4.12). Yet the survey also indicates that there is room for improvement. On one dimension, the high-tech firms indicate that workers need to improve their discipline, especially toward following the safety requirements on the job. Also, as Table 4.7 makes

![Figure 4.11](image)


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### Table 4.7

<table>
<thead>
<tr>
<th>INSTITUTION</th>
<th>QUALITY OF EDUCATION</th>
<th>QUALITY OF TRAINING PROGRAMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological Institute of Costa Rica</td>
<td>9.33</td>
<td>9.00</td>
</tr>
<tr>
<td>University of Costa Rica</td>
<td>9.02</td>
<td>8.75</td>
</tr>
<tr>
<td>National University</td>
<td>7.75</td>
<td>6.80</td>
</tr>
<tr>
<td>Private Universities</td>
<td>6.67</td>
<td>6.40</td>
</tr>
<tr>
<td>National Institute of Learning</td>
<td>7.90</td>
<td>7.75</td>
</tr>
<tr>
<td>Technical Secondary Schools</td>
<td>8.30</td>
<td>8.00</td>
</tr>
<tr>
<td>Other</td>
<td>8.50</td>
<td>8.30</td>
</tr>
</tbody>
</table>

clear, although the quality of the two main universities and technical schools is satisfactory, at least 70 percent of the respondents express concerns about the appropriateness of the short-term classes and training programs offered.

The operation of this new sector provides Costa Rica with an interesting opportunity, but also with serious challenges. If the sector is to grow, the country has to produce workers with the required skills. Figures 4.13, 4.14a, and 4.14b decompose the employment of the firms in the survey into different skill groups. In most firms, the largest share of employment is composed of production workers. But it is clear that, relative to any other sector, these firms are high-skill-intensive, since 25 percent of their labor force is composed of engineers and technicians, and 20 percent are skilled workers. Figures 4.14a and 4.14b decompose engineers and technicians into areas of expertise.

According to the survey, most of the firms indicated that they planned to increase their levels of operation. About 60 percent indicated that the growth will originate mainly from the expansion of existing lines, while 40 percent indicated that expansion will arise from new lines of production. The planned expansion is not small. The firms expect to hire approximately 2,100 new employees in 2001; 2,330 in 2002; and more than 2,600 in 2003. From their answers, it seems that the new demand will have a larger share of skilled than unskilled workers. Still, their projections include 500 engineers and technicians hired in 2001 alone. For the other two years the estimates are slightly lower.

The challenge for Costa Rica is to provide enough quantity and quality of professionals in those areas. Interestingly, the educational market seems to be catching up with the demands of the new sector. There is a significant increment in the areas of computation and information technology and in industrial engineering (Figure 4.15). At a lower level, the government and the market are also actively reacting to the new demand for skilled workers and technicians: in less than four years, enrollment increased by almost 10 percent in the technical colleges, reaching almost 44,000 students in 1999; the National Institute of Learning saw its student body increase from around 47,000 in 1994 to 124,191 in 1999.
1997; and the applications for diplomas and technicians (one- and two-year programs) in the Costa Rican Institute of Technology increased by almost 300 percent.

**Human Capital in Costa Rica and El Salvador**

Combined with stable institutions, the skills of the Costa Rican labor force made it the leading candidate in LAC for the development of high-tech industries. To effectively create a basis of skilled workers, technicians, engineers, managers, and other professionals, any country needs to have a solid primary and secondary education. Table 4.8 compares the statistics for Costa Rica and El Salvador. Costa Rica is far ahead of El Salvador, not only in coverage for all levels, but also in terms of the efficiency of the educational system (with the exception of pupils per tutor in secondary education). This observation becomes even more relevant once one realizes that El Salvador compares favorably with the other Central American countries (for example, Honduras and Nicaragua). Furthermore, these differences are the result of government policies. Figure 4.16 compares the expenditures on education in Costa Rica and El Salvador as fractions of GDP and government expenditures. Costa Rica spends much more in education, both because it is richer and because it spends a higher fraction of its income. The fractions declined during the 1980s, partly because of the fiscal imbalances and, in the case of El Salvador, increased military spending.

These differences show up, for example, in the degree of illiteracy in the population and its composition. El Salvador has a much higher illiteracy rate (28 percent compared to 5 percent in 1997), which is concentrated in the younger population. While the composition of the illiterate population in Costa Rica is becoming more concentrated in the elderly over time, the fraction of young individuals in the total illiterate population in El Salvador is high and increasing, reflecting the poor coverage of primary education and probably the impact of the war. This implies that, for long periods of time, El Salvador will have an active labor force with a high percentage of low-skilled workers.

**Summing Up: Different Paths of Development in the Future**

Costa Rica and El Salvador are similar countries in terms of natural and geographic conditions and cultural aspects. Also, from a macroeconomic perspective, they had similar performances during the 1990s, driven by exports and foreign investment. Nevertheless, the Costa Rican economy, supported by a highly educated labor force, experienced an important transformation during the period. Several technology-intensive firms started operating in the country, thus changing the profile of its employment and exports. El Salvador, on the other hand, concentrated its expansion mainly in traditional labor-intensive sectors, mainly apparel.

The operation of the high-tech firms in Costa Rica has a two-way relation with the quality of the labor force. First, its introduction was determined precisely by the relatively high quality of the local labor force. Second, at the same time, its successful operation demands increasing amounts and quality of labor at different levels. The great challenge for the Costa Rican economy is to respond adequately to the increased demand, by improving the overall quality of
universities and high schools, and education in rural areas. Besides, infrastructure reforms that have been lagging behind (such as telecommunications) can become a limiting factor if not dealt with in a timely fashion. If Costa Rica responds to these challenges, the possibility of attaining a sustained growth path—where investments in human capital reinforce growth, which feeds back into human capital accumulation—is an attractive and plausible development path.

El Salvador has a difficult task ahead: long-term growth could be limited by the quality of its labor force. A transition to more dynamic sectors is unlikely in such an environment. The demographic profile of the labor force in terms of the relation between ages and skills raises even more serious concerns about the long-term prospects. The gains obtained from the development of the traditional industrial sectors should be partly directed to an aggressive policy of investments in human capital to improve the coverage and efficiency of basic education. Recent innovations in the education sector of El Salvador, such as increasing parental involvement in the management of schools, could provide avenues for future improvements in this area. The recent adjustments in terms of infrastructure and telecommunications are important advances. But with low human capital, those investments might not lead to dynamic growth in labor productivity.

The Impact of NAFTA on Mexico's Trade Structure

In Chapter 2 we analyzed the evolution of Mexico's net export structure since the early 1980s. We noted that beginning in 1995, the country developed a clear comparative advantage in machine exports, especially in road vehicles, and office (data-processing) and telecommunications equipment. In the following subsections we take another look at Mexico's trade structure by comparing its structure within NAFTA to that observed with the whole world. After the analysis of the structure of trade, we turn our attention to the electronics industry, which includes the office equipment sector, including personal computers. The objective is to gain some understanding of whether Mexico's comparative advantage in these products has been transformed
from production processes driven by competitive labor costs or by the establishment of new industries driven by innovation and knowledge creation.

The Structure of NAFTA Trade

Figure 4.17 shows the structure of Mexico’s net exports to Canadian and U.S. markets during 1986–98. As with the structure of its net exports to the whole world, this chart shows a structural change toward the end of the period, when net exports of machines turned positive. This change was driven by exports of road vehicles, telecommunications equipment, and office and automated data-processing equipment. However, this change occurred in 1993 for exports to Mexico’s NAFTA partners, while it appeared a year later in the structure of overall net exports. Hence it seems that change occurred in anticipation of the actual implementation of the agreement in January 1994. It is worth recalling that the United States had approved fast-track legislation for the negotiation of NAFTA in 1991. Thus it is quite likely that foreign and domestic firms made investment decisions to expand their operations in Mexico prior to the formal implementation of the agreement. This interpretation of the evidence is consistent with econometric evidence provided by Freund and McLaren (1999), who find anticipated structural effects of trade agreements throughout the world. However, we must acknowledge that the exchange rate adjustment that took place in late 1994 might also have played an important role in stimulating exports of manufactures. But the fact that the structural change within NAFTA occurred earlier indicates that the negotiation of the agreement itself was an important force for change.

Figure 4.18 provides further descriptive evidence about the impact of NAFTA on Mexico’s trade structure. The graph shows the evolution of the Grubel-Lloyd index of IIT introduced in Chapter 2, as well as Brulhart’s (1994) index of marginal intra-industry trade (MIIT). The MIIT index measures the extent to which changes in trade structure are driven by IIT.

The graph contains the indexes constructed with data from Mexico’s trade with the world and trade with its NAFTA neighbors. The data clearly show that all four indexes of IIT jumped after 1991, when the formal negotiations were launched. Indeed, the intra-NAFTA indexes are virtually indistinguishable from the overall indexes for most of the period. Consequently, we can safely conclude that Mexico’s IIT is mainly driven by its North American trade. This is not surprising when one considers the fact that NAFTA merchandise exports rose from about 80 percent of total exports in 1991 to over 90 percent by early 2001. The share of merchandise imports originating in North America fluctuated around 75 percent during the last decade.
With this evidence in hand, it is difficult to deny that the negotiation of NAFTA had substantial structural effects on Mexican trade. The following subsection looks at the internal geographic distribution of FDI in Mexico. We attempt to understand how geography and some of the other "new" endowments such as human capital help explain the location of foreign firms within Mexico.

**FDI in Mexico: The Role of Geography and Human Capital**

There are several important questions related to the role of geography and human capital in the determination of foreign direct investment in Mexico. First, though the agglomeration of FDI on the border with the United States is well known, is distance the dominant factor, and hence...
are states or countries farther away at an insuperable disadvantage? Second, since Lucas (1979) showed that a human capital–augmented production function can generate radically different returns to capital than might be calculated on the basis of capital–labor ratios alone, how important is a well-educated work force to attracting FDI? Third, given the recent literature on agglomeration effects or infrastructure, how important is the concentration of economic activity in urban areas? Fourth, how much of a barrier to participating in FDI are language or cultural characteristics related to being members of indigenous groups? Put differently, is Chiapas marginalized because it is distant, poorly educated, rural, and heavily indigenous?

Figure 4.19 shows that most FDI per capita is concentrated on the northern border. However, there are important exceptions. First, the highest concentration is, in fact, in Mexico City, although this appears to result from the fact that companies with headquarters there might not register the actual location of their investments, but rather the location of headquarters. On the other hand, the states immediately around the capital also show high per capita rates, and the central region has, traditionally, been the

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**FIGURE 4.19**

**Mexico: Geographic Distribution of Variables**

Per Capita FDI (From 1994 to 2000)

- Millions of Dollars
  - 1–122
  - 122–452
  - 452–972
  - 972–1,812
  - 1,812–4,315

Schooling (in years)

- Years
  - 5.6–5.8
  - 5.8–7.0
  - 7.0–7.8
  - 7.8–8.5
  - 8.5–9.7

Degree of Urbanization

- Urban Population Share
  - 0.4–0.5
  - 0.5–0.6
  - 0.6–0.7
  - 0.7–0.8
  - 0.8–1.0

Percent Speaking Indigenous Languages

- Percentage
  - 0.00–1.00
  - 1.01–5.00
  - 5.01–17.00
  - 17.10–25.00
  - 25.10–37.00

center of industrial activity. Second, the region around Guadalajara in Central Mexico is not particularly close to the border, yet receives substantial FDI, perhaps due to the presence of Hewlett-Packard and other transitional firms. Finally, Quintana Roo, in the Yucatan peninsula, also shows relatively high FDI per capita.

Schooling is more evenly distributed, although it shows, again, the highest levels along the border, the central region, and Quintana Roo, suggesting some correlation with FDI as well. The difficulty of isolating the influence of any particular social variable is highlighted by the fact that the degree of urbanization also seems highly correlated with both education and FDI. This complicates attempts to identify the influence of ethnicity since the highest concentration of indigenous-language speakers is in the south, which also tends to have lower levels of both urbanization and education.

Again, the high degree of correlation of these variables means that multivariate analytical techniques are necessary, and these are presented in Table 4.9. Columns A, B, and C suggest that distance, education, and urban population share enter with the expected signs, although it is difficult to identify the impact of the last two. The share of indigenous population does not enter significantly, suggesting that there is no effect independent of the fact that these communities tend to have lower education levels, live in rural areas with less infrastructure, and are concentrated in areas far from the United States. Column D generates a positive impact of the indigenous variable if we drop a dummy included to capture the fact that, although Yucatan and Quintana Roo are very distant from the United States by road, they are very close to Miami by boat, and hence our distance measure is probably incorrect. The relatively high density of indigenous population appears to be correlated with relatively high FDI, given the road distance from the United States.

In sum, proximity to the United States, higher education, and more urbanized areas capturing perhaps agglomeration effects or infrastructure are positively correlated with FDI. However, areas with indigenous populations appear to receive less FDI only because they tend to also have lower education, are more rural, and are located farther from the United States. The following section explores in detail how geography and knowledge have affected the evolution of the electronics industry in Mexico.

The Mexican Electronics Industry
Can labor-intensive offshore manufacturing activities evolve into skill-intensive, high-value-added operations? What is the role of government promotion policies in the context of an open trade regime? Although there are no general responses to these queries, the recent experience of the Mexican electronics industry does provide some clues to what the possible answers may be.

Background and Facts
Between 1995 and 1998, Mexico’s GDP grew at an average rate of 5.9 percent per year. This impressive performance, after a quick recovery from the effects of the 1994 devaluation, was partly due to the dynamism of the country’s man-

### Table 4.9

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>COEF A</th>
<th>T</th>
<th>COEF B</th>
<th>T</th>
<th>COEF C</th>
<th>T</th>
<th>COEF D</th>
<th>T</th>
<th>COEF E</th>
<th>T</th>
<th>COEF F</th>
<th>T</th>
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<tbody>
<tr>
<td>Education</td>
<td>180.4</td>
<td>1.13</td>
<td></td>
<td></td>
<td>388.5</td>
<td>3.35</td>
<td>496.4</td>
<td>4.94</td>
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<tr>
<td>Urban Population Share</td>
<td>1343.3</td>
<td>1.67</td>
<td>2047.1</td>
<td>3.8</td>
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<tr>
<td>Percent Indigenous Population</td>
<td>364.6</td>
<td>0.28</td>
<td>–88.2</td>
<td>–0.07</td>
<td>230.5</td>
<td>0.17</td>
<td>1887</td>
<td>2.51</td>
<td>–5885.5</td>
<td>–2.7</td>
<td>–2698.8</td>
<td>–2.32</td>
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<tr>
<td>Distance to the United States</td>
<td>–47.1</td>
<td>–5.65</td>
<td>–49.5</td>
<td>–6.01</td>
<td>–47.9</td>
<td>–5.44</td>
<td>–42.4</td>
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<tr>
<td>Dummy</td>
<td>468.2</td>
<td>1.09</td>
<td>545.5</td>
<td>1.25</td>
<td>656.4</td>
<td>1.48</td>
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<td>Constant</td>
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<td>–1.14</td>
<td>–178.9</td>
<td>–0.55</td>
<td>–1644.1</td>
<td>–1.64</td>
<td>–2629.5</td>
<td>–3.15</td>
<td>509.4</td>
<td>3.71</td>
<td>413.2</td>
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<td>Sample Size</td>
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<td>LR chi2(df)</td>
<td>51.4</td>
<td>50.1</td>
<td>48.8</td>
<td>46.4</td>
<td>10.7</td>
<td>5.6</td>
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<tr>
<td>Pseudo R2</td>
<td>14.30%</td>
<td>13.90%</td>
<td>13.60%</td>
<td>12.90%</td>
<td>5.00%</td>
<td>1.60%</td>
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<tr>
<td>Log Likelihood</td>
<td>–154.3</td>
<td>–154.9</td>
<td>–155.6</td>
<td>–156.8</td>
<td>–174.7</td>
<td>–177.2</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: FDI lower than US$50 per period of 1995–2000 set to zero leading to 9 left-censored observations at FDI = 0, 22 uncensored observations. The Federal District (Mexico City) was dropped from the sample. Education is measured in years. Percent indigenous variable is calculated as the percentage of the population of age five years or older that speaks a native language. Dummy equals 1 for Quintana Roo and Yucatan, and 0 otherwise.

Manufacturing sector, the annual rate of growth of which was 9.4 percent during the same period (see Lederman and others 2001a, 2001b). Manufacturing exports evolved from 43 percent of total exports in 1990 to 85 percent in 1999. Within manufacturing, no industry matched the growth of the Mexican electronics manufacturers. Between 1995 and 1998, for instance, output and exports in that industry grew at average annual rates of 25 percent and 31 percent, respectively.

Exports of electronic products totaled US$29 billion in 1998, representing 27.6 percent of manufacturing exports. Although imports have also increased significantly, net exports of electronics products have been positive since 1995, attaining almost US$5.6 billion in 1998. As in other manufacturing industries, the United States is Mexico’s main trading partner in electronics, accounting for 93.8 percent of the country’s exports and 83.5 percent of its imports.

Although NAFTA led to the elimination of tariffs in the bilateral trade between Mexico and the United States, it did not pose a threat to their respective electronics industries. Indeed, the United States already had a very low tariff on electronics products (below 5 percent), and the Mexican exports of electronics are complementary to those of its neighbor. Indeed, the main Mexican export products are consumer electronics and data-processing equipment, mainly TV sets and computers, whose shares in total electronics exports are 17 percent and 15 percent, respectively.25 As for the Mexican imports, they consist largely of parts and components, notably semiconductors (20 percent) and scopes (11 percent).

In fact, the consumer electronics industry is even geographically integrated with the United States, with most manufacturers located in Mexico’s northern states, especially near the border. The state of Baja California, in particular, has attracted 81.6 percent of the investments made in the electronics industry during 1995–98, which amounted to more than US$2.3 billion, and is the host of the main Korean and Japanese manufacturers of consumer electronic products. As for the computer and telecommunications equipment industries, they are mostly located in Jalisco, which ranked second in terms of investments in electronics, totaling US$394 million during 1995–98. Concentrated in the city of Guadalajara, the electronics industry established in Jalisco grew 52.6 percent between 1993 and 1997, increasing its share of the national production of computer and telecommunication equipment from 31.9 percent to 71.4 percent, mostly at the expense of the Mexico City metropolitan area (see Casaneuva and Brown 2000). Among the main manufacturers of final products with plants in Jalisco are IBM and Hewlett-Packard, which established themselves in the 1970s, at the time when the Mexican policy for the informatics industry required foreign firms to produce locally in order to supply the domestic market. Other manufacturers with more recent investments include NEC, Unisys, Siemens, AT&T, Alcatel, Ericsson, and Motorola.

More than half of the manufacturers of electronic products operating in Mexico are maquilas. These are mostly foreign-owned companies that assemble imported components for re-export, benefiting from fiscal incentives and simplified administrative procedures. Although most maquilas are located near the U.S. border, the fraction of maquila employment located in nonborder states has increased from around 5 percent in 1986 to more than 22 percent in 2000.

The share of the maquila operations in total electronics industry employment increased from 38 percent in 1992 to 54 percent by 1998. Almost all the consumer electronics manufacturers operate as maquilas, and so do most makers of telecommunications equipment. The non–maquila segment of the industry operates under the same conditions as the rest of the manufacturing industry, and has stronger local ties, both in terms of markets and suppliers. In fact, until the opening of the economy to foreign trade during the late 1980s, the non–maquila electronics industries established in Mexico were oriented mainly toward the domestic market, in which they enjoyed considerable protection from import competition.

With trade liberalization, however, and particularly after the implementation of NAFTA, the outward orientation of the non–maquila sector has increased considerably. For instance, the ratio of exports to production in the non–maquila sector increased from 35.1 percent in 1989 to 60 percent in 1994 to 83.5 percent in 1996. In the specific case of the computer industry, it must be noted that the liberalization of trade only occurred in 1990, at least two years after the other subsectors of the electronics industry. Moreover, during three years computer manufacturers benefited from fiscal incentives that included tariff exemptions, in the context of a special regime that rewarded local technological development and the use of domestic parts and components.

With 637,000 workers in 1998, the electronics industry is a relatively large employer, responsible for 9 percent of
the jobs in manufacturing. Within the electronics industry, the maquilas have shown the strongest performance in terms of employment generation, and they have been responsible for most of the new jobs created in the industry. Between 1992 and 1998 employment grew 94 percent in the maquila sector, as opposed to a meager 3 percent in non-maquila companies. This is due both to the comparatively larger growth in the number of maquilas, and to the fact that these types of companies perform assembly operations that are relatively more labor intensive.

**Factors Determining Location**

As for the factors that explain the decision of foreign companies to locate production facilities in Mexico, it must be remembered that before the 1990s, and outside the maquila sector, the main motivation for setting up local plants was to gain access to the protected Mexican market. This motivation is no longer relevant, so the new foreign investors are driven, at least in part, by favorable local conditions relative to locations in other countries, in order to sell not only to the Mexican but also to the U.S. and other markets. Moreover, given the dramatic reductions in transport costs and the possibility of “fragmenting” the stages of the electronics manufacturing process, location decisions may now involve the fragmentation of those stages across different cities and countries.

The main motivation for setting up electronics manufacturing plants in Mexico has been the combination of low labor costs, geographic proximity to the United States and, particularly after NAFTA, trade preferences and certainty of access to the U.S. market. The role of geography and human capital in attracting foreign investment to Mexico has been analyzed in a previous section. The point here is that geography has been crucial in all segments of the electronics industry. However, among maquilas it has been coupled to a decision of locating only the labor-intensive assembly operations in Mexico, while using mostly imported parts and components. Although labor-intensive operations have also been the focus of non-maquila businesses, their range of products and operations has widened considerably toward more skill-intensive activities, and they have made a growing use of inputs produced locally by companies that have also been attracted to the country. This option has been favored among manufacturers of products with more dynamic technologies, computers for instance, who tend to supply the American market in a “made-to-order” regime.

As already mentioned, a very important factor in the decision to locate electronics manufacturing operations in Mexico is the possibility of exporting with zero tariffs to Canada and the United States, provided the NAFTA rules of origin are met. The possibility of the maquilas importing parts and components with zero tariffs has recently become restricted to imports from NAFTA partner countries, under a clause of the agreement signed in 1994. However, FDI has not been significantly affected, in part because the share of parts and components purchased within NAFTA has increased significantly, and because of the proliferation of free-trade agreements dropping the duties on imports from non-NAFTA countries. This is notably the case of the goods imported from the European Union, which will be tariff exempt under a free-trade agreement signed in 1999.

Moreover, for some Asian countries, a further incentive to establish maquila operations in Mexico is the fact that they face quantitative restrictions in the U.S. market. These aspects appear to compensate for the fact that manufacturing wages in Mexico are still higher than in several locations in Asia—China and Malaysia—and Central and Eastern Europe—Bulgaria, Hungary, and the Russian Federation. For instance, it has been estimated that the total landed cost (including inventory costs, tariffs, and shipping) of producing electronics products for the U.S. market is up to 5 percent lower in Mexico than in Malaysia (Merrill Lynch 2000).

Besides traditional cost considerations related to relative labor and capital abundance, a factor that has become crucial in the investment decisions of electronic companies is the feasibility of implementing efficient logistics structures for the relationships with both suppliers and customers. Indeed, because of the very fast rate of technological change in the electronics industry, with important technological “leaps” occurring with a frequency of less than two years, companies cannot afford to maintain sizable stocks of either final products or parts and components. For instance, it was indicated in interviews that a Pentium processor loses 10 percent of its value every month, which explains the need to maintain a strong integration among companies in the computer supply chain, mainly through the use of information technologies. In fact, the semiconductor industry is the one in which that type of integration appears to be most crucial (Mann 2001).

Although the need to produce “to order” derives to a great extent from the swift rate of technological obsolescence of electronics products, the high importance attrib-
uted to logistics is also related to the high degree of internationalization of the electronics industry. Particularly in recent years, due to widespread trade liberalization and plummeting transport costs, the production activities of electronics manufacturers have become increasingly fragmented across plants and countries. Thus, while total international trade grew 6.8 percent per year during the 1990s, trade in electronics products increased at an average annual rate of 15 percent.

The renewed importance of logistics implies a crucial role in location decisions for the availability of an appropriate transport infrastructure. In this respect, compared to other countries, Mexico benefits from the fact that products can be shipped by truck to the United States, reaching the border in less than 24 hours from many locations—18 hours from Jalisco to Texas, for example. Moreover, with the increased flow of airfreight between Guadalajara and the United States, the number of daily flights to and from several major cities in the United States has increased significantly—there was only one flight per day a few years ago. There are also a number of overnight airfreight companies such as DHL, Federal Express, and UPS that offer their services in Guadalajara (Merrill Lynch 2000).

**The Dynamics of Agglomeration**

Good logistics are also easier to implement when the companies that perform different parts of the manufacturing process decide to set up plants at the same location. At least in Jalisco this has been increasingly the case in recent years, and this has further contributed to the attractiveness of the region as a potential location for electronics manufacturers. To better understand these recent developments, it is worthwhile to sketch the stages of a typical production process in that industry. There are four main stages: R&D, manufacture of electronic parts and components, assembly of printed circuit boards (PCBs), and final assembly.

The first stage, R&D, is performed by so-called original equipment manufacturers (OEMs), which in turn distribute these activities across various R&D centers, which are often specialized in certain types of products. Larger OEMs usually have R&D centers in different countries, with each specific location determined by corporate strategies and the local availability of trained scientists and engineers. In the case of Jalisco, this availability appears to have played a role in the decision of several companies to implement locally the development of some of their products. It must be emphasized, however, that only after the advent of trade liberalization did those companies increase their investments in local R&D activities.

The requirements for the second-stage manufacturing activities vary according to the specific type of component. Although some components are relatively simple and their manufacturing processes are mostly labor intensive, the production of most of the inputs of the electronics industry is particularly capital- and knowledge-intensive, as is notably the case for semiconductors. Thus, in Mexico, most of the components used by the electronics industry are imported from the United States, and to a lesser extent, from Asia.

The two final stages of electronics manufacturing are the most labor intensive, and their location is determined mostly by cost and logistics considerations. Although the degrees of vertical integration vary by product and by corporation, most OEMs tend to focus on R&D and on final system-integration activities. They thus tend to rely increasingly on providers of electronics manufacturing services (EMS), which perform most of the third and fourth phases of the manufacturing process, and purchase their components from specialized suppliers. With the diffusion of “lean production systems” and “just-in-time” relationships between OEMs (or EMS providers) and their suppliers, a trend has developed in the direction of an increasing geographic concentration of integrated supply chains.

At least in Mexico, the regional agglomeration of electronics manufacturing activities has been led by the investments of OEMs, which, after being established in a particular location have, in some cases, attracted some of their suppliers of parts and components. This process has been relatively limited in the case of the maquila operations, which tend to purchase most of their inputs abroad. In the non-maquila sector, however, notably in the case of Guadalajara, the OEMs have been followed by manufacturers of some of their main inputs, including producers of components, PCBs, plastics, packing materials, and sheet metal, and electronics distributors. It is worth noting, however, that most of these companies are foreign, while domestic manufacturers are limited to activities with relatively low capital and knowledge intensity, such as packing materials, labels, and cleaning and maintenance services (Casaneuva and Brown 2000).

Recently, some of the leading EMS providers have also been attracted to the region by the OEMs to which they provide services elsewhere in the world. After the establish-
ment in 1987 of the first major EMS provider in Guadalajara, at least seven other leading companies have set up local plants in recent years, mostly after 1997. Some of the main EMS companies already in the region are SCI systems, Flextronics, Jabil Circuit, NatSteel Electronics, and Soletron. Although some of these companies, as well as other EMS providers, have plants in other Mexican cities—Hermosillo, Monterrey, Puebla, and Tijuana—it is clearly in Guadalajara that the largest concentration of EMS providers is found (Merrill Lynch 2000).

Interestingly, the establishment of EMS providers in the region is attracting more manufacturers of parts and components to Guadalajara, which could in turn increase the competitiveness of manufacturers of final products, potentially attracting further OEMs and EMS providers. Moreover, some recent modifications in the scope of the product lines manufactured locally by these companies suggest that they have been upgrading the technological content of their manufacturing activities. Thus, at least some of the EMS providers have been widening their local product lines in the direction of increasingly sophisticated products, for instance from personal computers and peripherals to notebooks, servers, and network equipment. Complementarily, within each product line, those companies have evolved from performing locally only the assembly of PCBs, to also internalizing the final assembly of full systems (Merrill Lynch 2000).

Some EMS providers have offered incentives for the establishment of parts and component suppliers, for instance in the form of instant access to necessary manufacturing infrastructure in their industrial parks. However, it is worth noting that government incentives have played no role in the Jalisco agglomeration, except, as mentioned, in the early years after trade liberalization. This fact has led industry leaders to lobby for fiscal exemptions based on claims that Jalisco would be losing important investment projects to countries that do offer fiscal advantages to investors, particularly in Asia.

The Role of Education and Knowledge Policies

As for the upgrading of the activities performed locally by EMS providers, in terms of their technological content, it has been stimulated in part by the local availability of skilled personnel. Indeed, the metropolitan area of Guadalajara has six universities and is the second most important educational center in Mexico. Although it is not clear what role this played in the location decisions of the first OEMs established in Jalisco in the 1970s, interviews with industry leaders suggest that there are significant externalities derived from the availability of a skilled workforce in the region.

In particular, the presence of trained scientists and engineers partially explains the establishment of R&D centers by the main OEMs, which have developed locally some products—printers, for instance—that are now manufactured in other countries. Moreover, one of the leading companies in the industry has decided to transfer from the United States to Guadalajara part of its strategic financial operations, a decision that also reveals the high quality of the local telecommunications infrastructure. There is also evidence of increasing collaboration between local universities and the electronics manufacturers established in Jalisco, although it has so far been mostly limited to the training of personnel and support for the establishment of new local R&D centers by OEMs (Casaneuva and Brown 2000). The growth of the development activities performed in these centers could in principle lead to spinoffs in the form of the appearance of new, technology-based companies that would take advantage of the availability of trained personnel, with work experience in the OEMs’ R&D centers. As indicated in interviews, these types of incentives are behind the ongoing development of a local software industry.

Summing Up

In recent years the electronics industry has been one of the most dynamic in the Mexican economy, both in terms of output and export growth. Particularly after the implementation of NAFTA, the differences between maquila and non-maquila companies in terms of outward orientation have been reduced, as the latter have considerably increased both their exports and imports. However, unlike the consumer electronics manufacturers, which operate mostly as maquilas in the northern border states, importing almost all of their inputs, the companies that manufacture computer and telecommunications equipment in Guadalajara have created strong ties to other companies established in the region. Indeed, they have been able to attract the providers of electronics manufacturing services and the suppliers of parts and components that they use in other locations throughout the world. These investments appear to be leading to the creation of integrated supply chains, which could lead to important gains in competitiveness, based on
both lower costs and better logistics. These gains should attract new manufacturers, generating a virtuous circle in which the expansion of the industrial agglomeration generates externalities that contribute to further cost reductions, particularly through the improvement of logistics, and thus leads to the attraction of new investments.

Overall, the case of the electronics manufacturing companies in Jalisco highlights both the possibility of evolving from pure maquila-type assembly operations to skill-intensive manufacturing and R&D activities, successfully integrated into global networks. This case also illustrates the crucial role played by the externalities derived from a good education and transportation infrastructure, and the increasing returns associated with the establishment of integrated supply chains. Some of the first manufacturers were established in Jalisco at the time when protectionist policies required local production to access the Mexican market. However, it must be noted that such a chain of events would be improbable in smaller countries where the size of local market does not justify tariff jumping. Also, the development of integrated supply chains and the technological upgrading of the activities performed locally took place only during the period that followed trade liberalization, particularly after NAFTA. Finally, it is worth noting that the role of government policies has recently been very limited, with no fiscal incentives being granted to new investors outside the maquila sector.

Tourism and Development in the Caribbean
Tourism is a critical export sector for many countries in the region. For many economies in the Caribbean, tourist receipts are the majority of exports, and their share in GDP can rise above 40 percent (1998 data) (see Figure 4.20).

Further, tourism is a growth industry globally. The arguments that suggest that primary products will enjoy a decreasing share of world income apply in reverse as increasing incomes and more leisure time raise tourist expenditures proportionally more than income. This is suggested by Figure 4.21, which shows annual growth rates in real global tourist expenditures of over 3.8 percent for the last 20 years. Some economies in the region have been able to take advantage of this growth. In the Dominican Republic, for example, tourism has been a booming sector, rising from 9.1 percent of total exports during 1971–1980 to 29 percent by 1991–2000. However, similar to commodities, the supply of alternatives also affects revenues. Tourist expenditures in Latin America have risen .51 percent over the comparable period, and the region has dramatically lost market share. This suggests growth opportunities for many countries of the region.

Tourism and Development
The impact of tourism can be significant on the local economy, and both input-output and computable general equilibrium (CGE) analysis can reveal the magnitude and nature of its effects.

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**FIGURE 4.20**

Tourism’s Share of Exports and GDP

![Tourism's Share of Exports and GDP](chart.png)

of linkages. As Table 4.10 shows, the GDP multiplier for Barbados is 1.4, close to the average calculated for other countries and at the high end of industry multipliers.\footnote{28}

Though more difficult to measure, the contribution to labor creation can be large. For the Windward Islands and Leeward Islands tourism directly and indirectly accounts for up to 24 percent of total employment, with direct employment accounting for 49 percent of the workforce in Anguilla. Employment multipliers range widely from 1.4 for Barbados to estimated magnitudes of 3 in the Windward Islands and the Dominican Republic.

Although it is difficult to generalize based on the available data, for Barbados the impact on government finances seems favorable. The state receives over 10 percent of tourist spending and the ratio of revenue to spending on infrastructure and other services exceeds 1.5. Finally, the impact of tour ship arrivals is smaller along most dimensions. This is to be expected given the lower spending on housing and food that would have linkages to the rest of the economy.

In Barbados, this may be partially accounted for by the high foreign content of “shopping,” which is estimated at 75 percent. Still, the contribution of cruise ship spending is

\begin{table}[h]
\centering
\caption{Results from a Limited Input–Output Model for Barbados}
\begin{tabular}{lll}
\hline
 & Overseas & Cruise & Total \\
\hline
\textit{Contribution to GDP} & & & \\
Direct Contribution to GDP (at factor cost) & 12.9\% & 1.3\% & 14.2\% \\
Direct and Indirect to GDP (at factor cost) & 18.4\% & 1.5\% & 19.9\% \\
GDP Multiplier & 1.42 & 1.15 & 1.4 \\
Tourism-Related Imports/Tourism Spending & 31.2 & 39.8 & 31.9 \\
\hline
\textit{Impact on Employment} & & & \\
Direct Employment & 17,634 & 1,427 & 19,061 \\
Indirect Employment & 6,133 & 202 & 6,335 \\
Direct + Indirect/Total Employment & 22.5 & 1.5 & 24.1 \\
Employment Multiplier & 1.548 & 1.142 & 1.332 \\
\hline
\textit{Impact on Government Finances} & & & \\
Tourism-Related Government Revenue & 121,228,325 & 10,757,247 & 131,985,572 \\
Tourism-Related Government Spending & 78,942,311 & 8,771,368 & 87,713,679 \\
Revenue/Spending & 1,556 & 1.226 & 1.505 \\
Tourism Related Government Revenue/Tourism Spending & 11\% & 12.2\% & 11\% \\
\hline
\end{tabular}
\smallskip
\textit{Source:} Caribbean Development Bank 1996.
\end{table}
not negligible. In the Galapagos, cruise ships owned by entities on the mainland generate 46 percent of the total value added on the islands, channeling income through crew wages and inputs supplied by the islanders. Locally based cruise ships accounted for 17 percent of gross island product, followed by fishing (8 percent), commerce (7.5), and farming (5 percent). In short, a small economy can be largely supported on the multiplier effects of cruise ship visitors.

**Possibilities for Growth**

As Figure 4.22 suggests, revenues from tourism constitute a large fraction of both exports and GDP in many economies in the Caribbean. The natural question arises as to what the long-term potential for growth is. If at some point the number of tourists reaches the physical capacity of the environment, then how does income continue to rise?

We can think of the income per tourist resource (for example, beachfront, Mayan ruins) as

\[
Income = \frac{L \cdot V \cdot S}{B \cdot L \cdot V}
\]

where \(L\) is the capacity for lodging over the potential for total lodging dictated by the environment (beachfront, for example), and hence the first term measures the degree to which the natural tourist potential has been exploited physically. The second term is the “occupancy rate” of lodging potential, or the number of visitors over total potential visitors. The final term is the spending per visitor.

Increasing “productivity” of the value generated, given the tourist base, can occur along all three dimensions.

1. **Expand Capacity**: For long-established tourist destinations such as Barbados, the expansion of accommodation capacity is limited to replacing existing hotels with larger hotels or, alternatively, floating capacity offshore in the form of cruise ships. The second type of tourist, the cruise-ship tourist, tends to spend less overall, but given the expansion in the number of total tourists, they are desirable, and hence there is strong competition among islands to attract them.

2. **Reduce Vacancy Rates**: Room-occupancy rates in the Caribbean in 1999 averaged 65 percent, ranging from over 80 percent in Anguilla to 30 percent in Belize. Hence, there is room for using existing capacity more completely. Economists at the CTO have suggested that local establishments adopt a system similar to that used by the airlines to ensure full booking. These gains, although potentially large, are “one-off” and cannot be extended indefinitely.

3. **Increasing Value per Tourist**: Expanded capacity and reducing vacancy rates are fundamentally “extensive,” and once exhausted, only increasing spending per tourist offers the potential for continued growth. Figure 4.22 suggests that high value added tourism can play a large role in a development strategy. For example, 50 percent of Bermuda’s GDP comes from tourism, and the mean spending per tourist is very high—roughly US$200 per visitor day. The relationship with GDP could imply that raising value per

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**FIGURE 4.22**

Real Tourism Receipts per Tourist Day

![Real Tourism Receipts per Tourist Day](image)

The results are slightly more positive if we look at tourist receipts not in terms of how much one visitor buys in terms of a basket of U.S. goods, but in terms of the manufacturing unit value index used to compare the evolution of commodity prices. However, overall, we do not find tremendous gains in the value per tourist over time. This suggests that islands are overall not very mobile in the quality of their product. Further, it suggests that, without initiatives to find other ways for tourists to spend their money, the growth benefits will not be realized.

**Is Tourism Fickle?**

Table 4.11 presents the standard deviation of growth rates of exports for several commodities that often complement tourism in island economies, particularly. What drives volatility separates tourism from the other commodities. Where price fluctuations are perhaps the larger concern for commodities, it is the sudden decline in tourist arrivals due either to recession in the country of origin or increased attractiveness of alternative destinations that causes more concern for tourism. But what is clear is that in virtually every case, tourism revenues are the least volatile. Only in Trinidad and Tobago do tourism revenues vary by more than the other commodities and, even then, by very little.

The central concern is that either a perceived similarity among islands or simply a fad will lead to a rapid redirection of tourists to other locales. Put more technically, the price elasticity of demand for tourism is very high. The only published study to date (Rosenzweig 1988) finds very high inter-Caribbean elasticities of over 2—a 1 percent rise in one island’s prices will lead to a loss of 2 percent of its tourists, and an elasticity of 1 with respect to Mexico. Our findings,

The tourist has helped lead to higher income levels, or it may imply that in high-GDP countries, higher labor and land costs imply a higher-cost tourism product and hence higher spending per tourist. But it must also be the case that the product is proportionately better, and this highlights the need for continued innovation and differentiation of the tourism product. Bermuda and St. Martin can be more expensive only if a similar service cannot be easily found elsewhere. The question of substitutability is discussed later.

Has the Caribbean been increasing revenues by expanding the number of tourists, or by increasing the value of their product? Figure 4.22 suggests a very mixed answer. For Bermuda, Curaçao, and Barbados inflation-adjusted receipts per tourist have been stable or increasing, but in Antigua and Barbuda, the Bahamas, Aruba, and Martinique, the tendency over the last decade has been downward.

This may be partially due to the fact that “tourists” include both cruise passengers and overnight visitors. An increase in the relative proportion of cruise passengers could lead to an apparent decline in spending per visitor when, in fact, all we see is a desirable increase in lower-spending tourists. Table 4.10 suggests that it is highly likely that cruise ship receipts per person have decreased significantly—by about 5.5 percent per year—and that overnight stays may, optimistically, have increased by 1 percent. Decline or small gains could be due to two factors. First, the rise of “all-inclusive” packages, while not necessarily decreasing the demand for goods and services of the host, does give large tour operators greater bargaining power with local providers. Competition from other destinations, including within the United States, has also put downward pressure on prices.

**TABLE 4.11**

*Export Revenue Volatility (Standard Deviation of Growth Rate)*

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>TOURISM</th>
<th>SUGAR</th>
<th>FRUITS</th>
<th>COFFEE</th>
<th>PETROLEUM AND GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados</td>
<td>0.08</td>
<td>0.17</td>
<td>0.33</td>
<td>0.96</td>
<td>3.61</td>
</tr>
<tr>
<td>Belize</td>
<td>0.36</td>
<td>0.11</td>
<td>0.21</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>Dominica</td>
<td>0.11</td>
<td>2.55</td>
<td>0.91</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>0.11</td>
<td>0.13</td>
<td>0.08</td>
<td>0.32</td>
<td>0.69</td>
</tr>
<tr>
<td>Grenada</td>
<td>0.17</td>
<td>2.39</td>
<td>0.49</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>Haiti</td>
<td>0.13</td>
<td>2.79</td>
<td>1.09</td>
<td>0.71</td>
<td>1.65</td>
</tr>
<tr>
<td>Jamaica</td>
<td>0.09</td>
<td>0.23</td>
<td>0.15</td>
<td>0.71</td>
<td>1.65</td>
</tr>
<tr>
<td>St. Kitts and Nevis</td>
<td>0.11</td>
<td>0.37</td>
<td>0.91</td>
<td>1.82</td>
<td>0.94</td>
</tr>
<tr>
<td>St. Lucia</td>
<td>0.09</td>
<td>1.13</td>
<td>0.29</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>St. Vincent and Grenadines</td>
<td>0.17</td>
<td></td>
<td>0.30</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>0.29</td>
<td>0.23</td>
<td>0.22</td>
<td>0.28</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>0.4315</strong></td>
<td><strong>1.84</strong></td>
<td><strong>0.99</strong></td>
<td><strong>1.522</strong></td>
<td><strong>2.34</strong></td>
</tr>
</tbody>
</table>

a. Includes all the countries.
although not strictly comparable, are much lower—about 0.4—and agree broadly with results from Spain and the Mediterranean. This seems a bit more plausible for two reasons.

First, what determines the price responsiveness of tourism is, as with manufactures, product differentiation. If all destinations are identical beaches, then price elasticities should be very high. Similarly, as wages rise in such an economy over time, we would expect the tourism sector to contract over time and move to other locales. But we do not observe this in the case where a destination has something very particular to offer. France has very high wages and a booming tourist industry due to the fact that demand to see the Eiffel Tower is virtually vertical—double or triple the price and people will still go. However, the Dominican Republic, which has developed largely on mass-based tourism with little “product differentiation,” is closer to the identical beach story. To date, the Caribbean islands have tended to offer a fairly differentiated product. British tourists charmed by the Barbados’s air of “little England” are not likely to visit Bob Marley’s stomping grounds in Jamaica because of small movements in prices. The French patronize their old colonies Guadeloupe, Martinique, and St. Martin, the Dutch Curaçao and St. Maartin, and they are not likely to be drawn to Cancun because of modest changes in prices.

Second, accommodation prices are keyed to the external market, and over the medium term changes in exchange rates or wages are likely to reflect more in profits than in prices. Over the longer term, we may expect more hotel building in areas with higher profit levels, such as Cuba. This is probably not the case with large economies such as Brazil and Mexico, where a large share of what the tourist consumes is “interior,” and hence would be more affected by exchange rate changes.

However, decreasing transport costs and the development of venues in Asia or even in the United States do offer alternatives that will increase this elasticity over time. Somewhat counterintuitively, Cuba’s coming on line may have a salutary effect by calling more attention to the Caribbean Basin relative to other regions.

In sum, tourism remains a desirable sector with growth potential in the region. However, the same lessons apply to the tourism sector as to any other resource sector.

1. Playing to Resource Strength. Many of the economies of the region have the potential to tap into the tourism market: most obviously Costa Rica, Ecuador, and Trinidad and Tobago increasingly find their niches as ecotourism destinations. Argentina and Chile have seen increases in tourism to their Patagonian extremities. Areas rich in natural beauty or simply beachfront, such as Brazil, could expand. Peru could follow Mexico with a more intensive marketing of its historical and cultural past.

2. Increasing Value per Tourist. For countries or islands with mature tourist industries, or in areas where environmental concerns prohibit further extensive development, improved “productivity” gains will come from providing more targeted and specialized tourist services. This can range from adventure tourism, such as shark or wall diving, to greater emphasis on cultural or historical tourism. In these cases, as with other natural resource-rich exports, there is a great possibility for applying human capital and know-how to add value to the basic resource. At the same time, relentless pursuit of product differentiation—for Trinidad and Tobago, perhaps a global steel pan competition; for Chile, the extremeness of the northern Atacama Desert; for Argentina, the Train of the Clouds—are the way to maintain market share and value as wages rise in the rest of the economy, and to reduce the fickleness of tourists.

3. Going Online. To use Mann’s (2001) terminology, tourism is a very information technology-sensitive industry. Getting the message out, defining the image, facilitating arrangements, and engaging in differentiated pricing through the Internet will be the base level of competition over the next decades. Further, arrangements are increasingly being made electronically. Travel booking will generate US$3.1 billion by 2002 (Holder 2001).

4. Increase Research. Tourism represents another case where substantial R&D is essential to take advantage of market opportunities. The global market is evolving rapidly, and niches open for specialized products. Yet, at present, tourism statistics are not ideally suited to the types of analysis required; the Caribbean Hotel Association, the regional private sector tourism organization, has no research program; and the universities are not heavily invested in this area (Holder 2001).

Notes

1. This section is based on Lederman and Soares (2001).
2. This section borrows heavily from Foster and Valdés (2001).
3. The last term in the decomposition of price movements is computed as a residual, combining changes in trade and price interventions and other possible changes in variables affecting the margins between domestic and border prices. The reader should also consider that, although the real exchange rate is equal for all products at any point in time, for each product the relevant domestic and border...
prices and the exchange rate were computed at the harvest month corresponding to the product in question. For milk and beef, sold throughout the year, the exchange rates represent an annual average.

4. The data for domestic prices of apples are suspect.

5. In general, while the immediate reaction might be to consider this outcome a cost of adopting a certain market-oriented economic policy (to be balanced against corresponding benefits), upon reflection, it is not obvious that it has been or will be in the medium term a serious detriment to Chile. To the degree that Chilean agriculture can incorporate varieties and techniques developed elsewhere, there would be less to gain by replicating a system of taxpayer support for universities and other institutions specializing in agricultural research leading to beneficial but hard-to-internalize results. Even with respect to the human capital necessary to make use of the latest agricultural production and processing technologies, the benefits of absorbing the fixed costs of sustaining large agricultural research facilities are diminished in light of the access to foreign graduate programs, consultants, and scholars. The marginal dollars spent on a publicly funded, long-term, public good–oriented research project or educational institution specializing in agriculture might offer higher returns if used to give a potential Chilean agronomist or engineer the basic training and English proficiency necessary to take advantage of technical services or educational opportunities available elsewhere. This would be especially so if similar projects—leading to the same publicly accessible results—are already being conducted at the expense of foreign taxpayers who have been conveniently persuaded of their duty to support public research efforts and sophisticated graduate training programs.

6. This section is based on Sanguinetti, Pantano, and Posadas (2001a).

7. The Asuncion Treaty also stipulates far-reaching objectives in terms of coordination of policies in other areas, particularly, policies applied in the following sectors: agriculture, industry, public taxes and expenditures, monetary rules, exchange rates, capital market, services, transport, and communications.

8. The Herfindahl concentration index was discussed in Chapter 2.

9. The magnitude of the fall in the concentration indicator (the gain in diversification) depends on which index we use. For example, using the Gini Coefficient, export concentration falls about 10 percent, while using the Theil Coefficient, the fall is nearly 20 percent.

10. The commodity groups are the one-digit Harmonized System of Classification aggregates. Results do not change when using alternative groups.

11. On the other hand, antidumping actions are still permitted (as of mid-2001), although there was a compromise to eliminate them by the end of 2000. See Sanguinetti and Salustro (2000) for details about tariff and nontariff barriers in Mercosur.

12. This argument applies not only to goods subject to economies of scale.


14. See Bonelli and Fonseca (1998) and Rossi Júnior and Ferreira (1999). The recovery in manufacturing productivity is also supported by calculations performed on the basis of the available microlevel data, which are representative of medium and large but not of the supposedly more dynamic small firms. For instance, Muendler, Sepúlveda, and Servén (2001) find an increase of 1.8 percent in manufacturing productivity growth from 1987–90 to 1991–98.

15. It is worth noting that the problems of endogeneity related to reverse causality from productivity to trade openness are minimized in these studies because of the use of firm-level data.

16. This section is based on Fajnzylber (2001a).

17. See Dagnino (1993) for an account of the government benefits received by EMBRAER.

18. See Luzio and Greenstein (1995), for example, for an analysis of the price and performance practices of the Brazilian microcomputer industry, which until 1990 was subject to severe local content requirements and lagged international standards by at least three and as much as five years.

19. In this new family of jets, the number of suppliers is also expected to decline, from more than 400 to around 40, with "first line" suppliers becoming system integrators themselves. This should lead to a further reduction in the manufacturing and integration activities carried out within EMBRAER (see Bernárdez 2001).

20. The risk-partnership arrangement was initiated when EMBRAER was still a state-owned company, in order to pursue the EMB-145 project in the context of a severe shortage of resources faced by the company at the time. EMBRAER’s share in the EMB-145 and EMB-170/190 projects is, respectively, 60 percent and 45 percent. In the case of the EMB-145, the support of Banco Nacional de Desenvolvimento Econômico e Social (BNDES) was also instrumental, because it financed US$100 million of the development costs (Bernárdez 2001).

21. This section is based on Monge-Naranjo (2001) and Rodríguez-Clare (2001).

22. EPZs in Costa Rica include firms from the Zonas Franca y Perfeccionamiento Activo.

23. Briefly, the other reforms were the following: In the area of electricity, the rates were very high, so the government asked the regulator to establish a new lower rate for energy-intensive industrial facilities. In the area of taxes, there was an ambiguity in the applicability of a new tax to companies in the EPZ system, so the government requested a formal interpretation from the Attorney General, which turned out favorable to Intel and other companies then entering the EPZ system.

24. This section is based on Aroca and Maloney (2001).

25. In fact, Mexico is the largest supplier of TV sets for the U.S. market, and the second-largest supplier of electronics products in general, surpassed only by Japan.

26. On the role of human capital, see Box 4.5 and the section on the experiences of Costa Rica and El Salvador.

27. This section is based on Maloney and Montes Rojas (2001).

28. Aroca (2001) calculates multipliers for Chile of real estate 1.02, agriculture 1.14, construction 1.21, transportation and communication 1.27, mining 1.28, manufacturing 1.28, retail 1.31, fishing 1.35, business services 1.41, and utilities 1.66.

30. Interview with Luther Miller, CTO (2001).
31. We regress total receipts on the number of overnight tourists (or overnight adjusted for reported average length of stay, or hotel occupancy rates times installed room capacity) and number of cruise ship visitors. Though a long-term cointegrative relationship might be expected, the results were much more stable in differences.
32. A study commissioned for the Caribbean Development Bank (1996) concluded that there was no evidence that all-inclusives consume fewer local goods and services than any other stay-over visitors. Spending through one supplier, however, provides a stronger position with subcontractors. Hence these packages might have the same overall impact but different distributional implications.
33. We follow Arellano and Bond (1991) in running a dynamic panel specification in differences of number of tourists from five geographic areas to each island on the calculated purchasing power parity in each country relative to the principal competitor countries, and several measures of total tourist demand.
34. We are grateful to Mr. Luther Miller of the CTO for this point.